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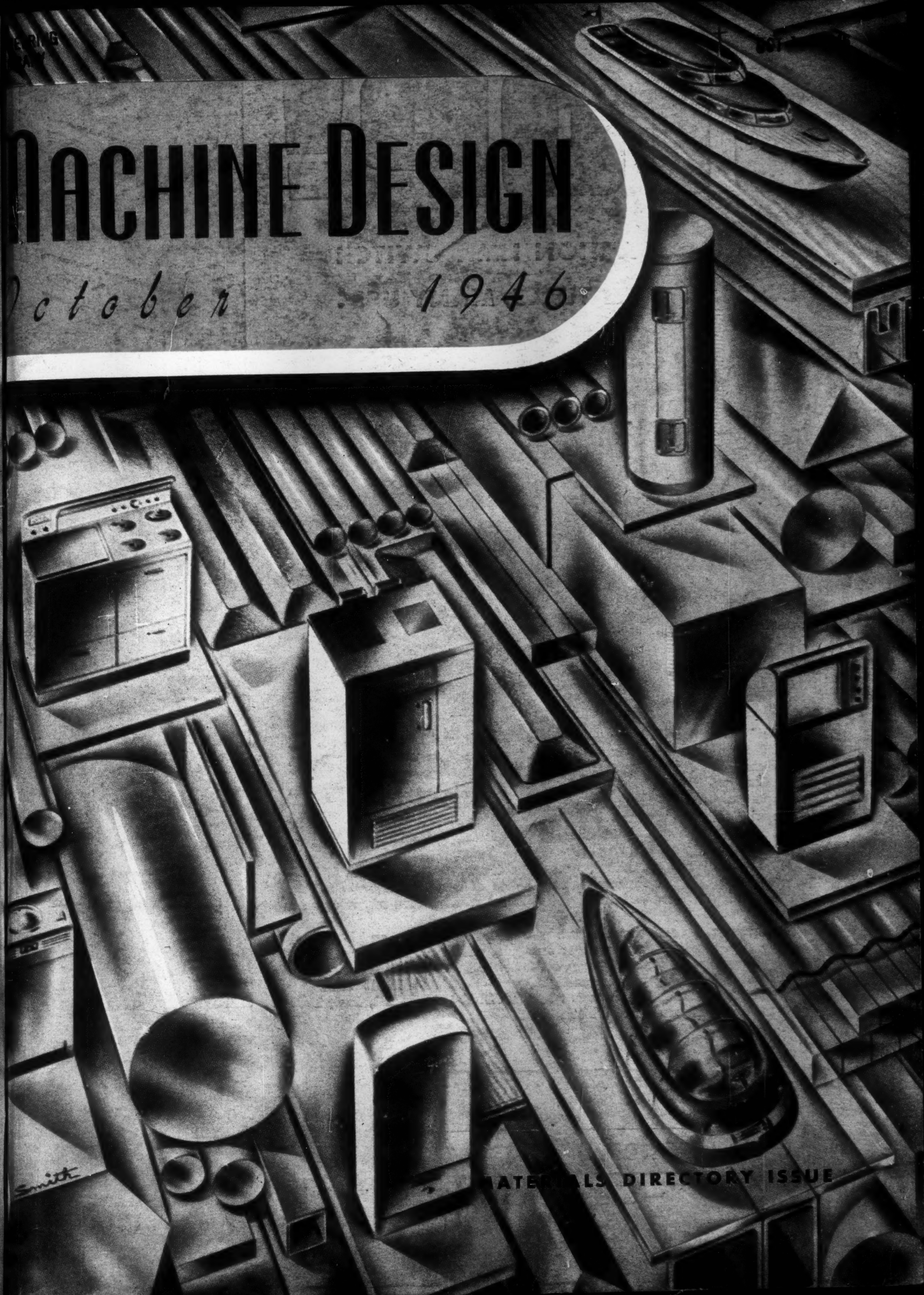
MACHINE DESIGN

October 1946



MATERIALS DIRECTORY ISSUE

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The Cutler-Hammer Bulletin 10316 Limit Switch, available in roller lever, push roller or push rod operating heads, all of which are interchangeable, meets many different needs on machines, machine tools, cranes and hoists. The roller lever type is furnished either with trip in both directions or with trip in one direction and by-pass in the other direction.

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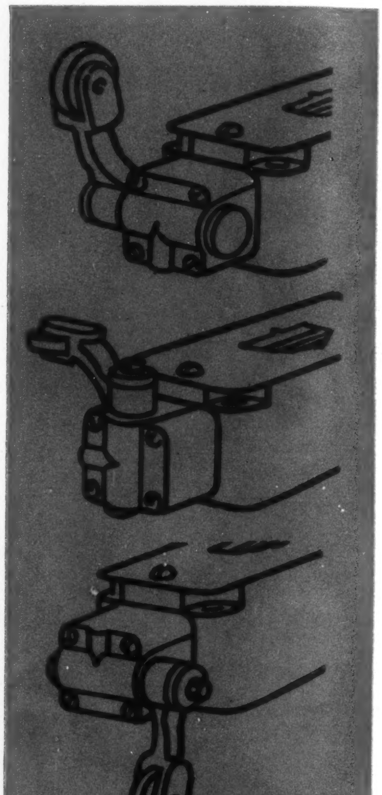
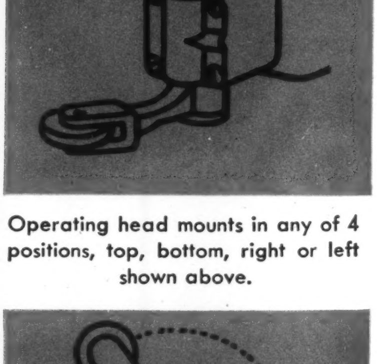
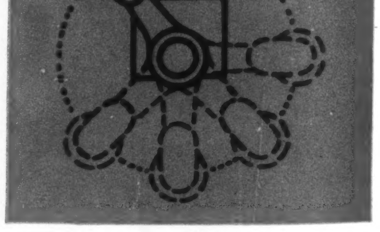


Operating head mounts in any of 4 positions, top, bottom, right or left shown above.



Roller lever may be set in any of 90 different positions, 4° apart as shown above.



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MACHINE DESIGN

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MACHINE DESIGN
October 1946

THIS MONTH'S COVER: Materials behind the machines. The illustration depicts the vast wealth of materials from which a designer may make his choice in the development and improvement of his machines and indicates the scope of coverage of the Directory of Materials contained in this issue.

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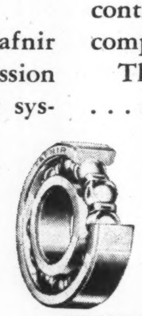

MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

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Classified for convenience when studying specific design problems

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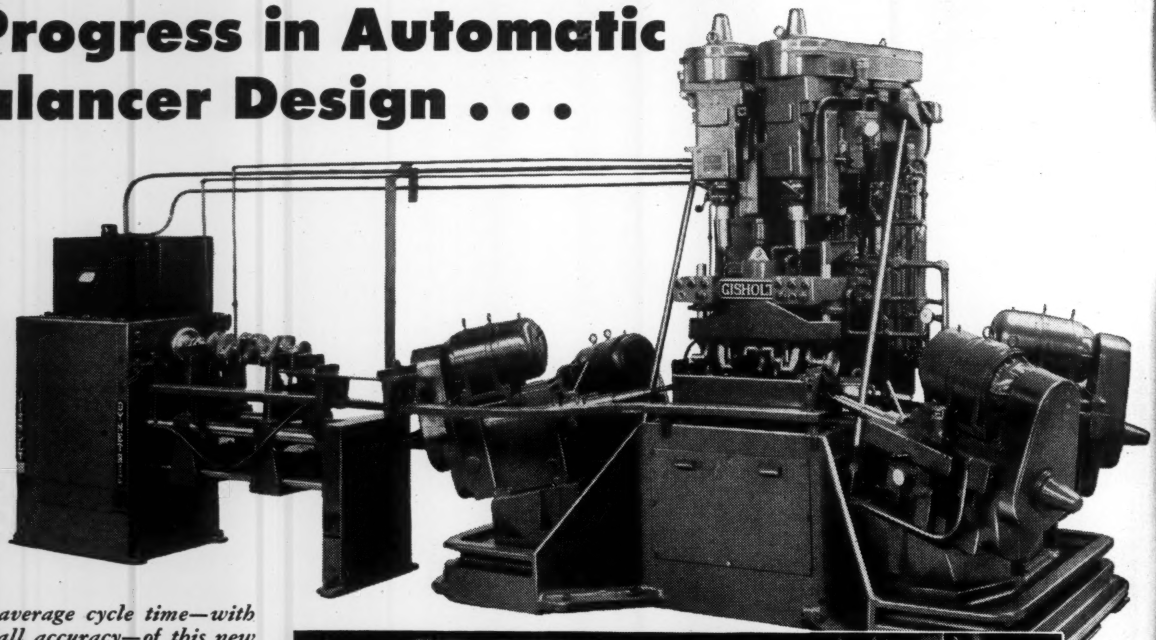
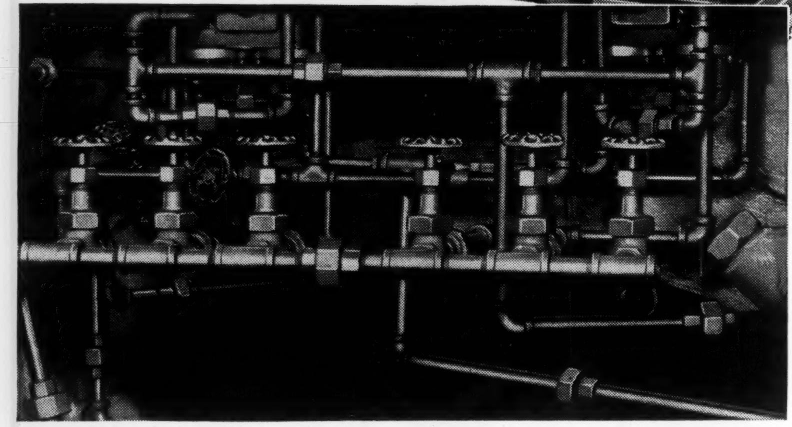
New Progress in Automatic Balancer Design . . .



66 SECONDS is the average cycle time—with 0.2 ounce inch overall accuracy—of this new semi-automatic machine for measuring and correcting unbalance in automotive type crankshafts. The unit combines a dynetric balancer connected with a multiple spindle drilling machine. Primary control is electronic, actuating hydraulically fed correction drills. Lifting and positioning of crankshafts is also hydraulically controlled. The unit is a development of Gisholt Machine Co., Madison, Wis.



(Right) Main control valves and fittings in hydraulic and coolant lines on driller—a small part of the unit's complex piping system which is Crane-equipped.

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Could the designer safely risk any part of the integral piping to less capable selection at the point of installation? Could he be sure of the unit's performance with piping of unknown dependability?

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Margo Black, *J & H Associate*
Plant No. 4

Even a flat wheel on a streamliner isn't as bad as an odd-sized ball in a ball bearing. That ball wears too fast, increases friction, leads to break-downs and needless cost. But no one could see or measure rapidly the fraction of an inch that would make that costly difference. So Jack & Heintz found a way. They developed an electronic ball sorter that separates balls automatically into 10 groups, the diameter of each group graded to an accuracy of *ten millionths of an inch* . . . and it does this *8 times as fast* as conventional equipment.

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Topics

TO ENCOURAGE ANALYSIS of statistical data, G. S. Merrill, Engineering Department of General Electric's Nela Park, has developed a slide-disk calculator for determining the root-mean-square average of any series of values, standard deviation of a set of values with respect to a desired sample, correlation coefficients, etc. The instrument is easily used, giving direct readings within slide-rule accuracy.

NATION'S CAPACITY to produce aluminum from ore on a competitive, integrated basis is well over a billion pounds a year and, according to George R. Gibbons of the Aluminum Co. of America, actual production of the whole industry will soon approach this theoretical capacity.

RUNNERS on canister type vacuum cleaners were found to be unnecessary on a certain model as far as utility is concerned. Because a market survey disclosed that housewives believe a cleaner pulls more easily with the runners, a manufacturer added them for psychological effect.

TEN-YEAR TEST on neoprene and natural rubber, both exposed to the weather under strain, disclosed that the neoprene composition retained 72 per cent of its original tensile strength and 85 per cent of its elongation. The natural rubber cracked so extensively that it was unfit for service.

ENGINE COWLING on aircraft, opening like an automobile hood, will cut ground handling time considerably by helping mechanics to reach any part of the power plant.

ODDEST HELICOPTER used in World War II was built by the Germans. Known as the V-4, its rotor blades are revolved by the exhaust from a jet engine, piped to the blade terminals. Superior features include freedom from torque, elimination of transmission system, excellent hovering performance, and simplicity of design. Fuel consumed by the jet is approximately six times greater than that of a standard helicopter but the engine is used for such brief periods that this fuel consumption is not considered a serious disadvantage.

ATOMIC GAS eventually is expected to power locomotives from coast to coast at a cost of $1, according to F. Alden Miller, Buffalo Machinery Co. With the aid of a rectifier, combustible gas is produced from commercial atomic C uranium. Such a system is in operation and has been producing gas successfully for half a year.

SILICONE OIL is being used successfully as a mold release agent in molding mica parts for electrical equipment. According to General Electric Co., the silicone does not deposit harmful decomposition products on the parts and reduces breakage encountered in removal of parts from the mold.

LIGHTWEIGHT WIRE for electrical systems is 30 per cent lighter and 15 per cent smaller in diameter than conventional wire. Developed for aircraft, the wire is covered with a layer of glass fiber over which a fire-resistant and chemical resistant synthetic rubber is applied.

DURABLE SHADES of brown colors for industrial enamels, paints and possibly plastics are forecast by the Du Pont Co. in the development of a new pigment called "auric brown".

CAPTURED GERMAN DOCUMENTS were so hard to read, the Air Materiel Command at Wright Field is compiling a dictionary with 75,000 German-English definitions. Increased number of terms and their confusing usage brought about by World War II made translations by academic methods almost impossible.

MACHINE DESIGN

What's New in Alloy Steels?

By J. M. Hodge and M. A. Grossmann
Research and Development Division
Carnegie-Illinois Steel Corp.
Pittsburgh, Pa.

REGARDING both severity of service and high quantity of production, demands were tremendous for alloy steels during the war years. To meet these demands with limited supplies of alloys and to produce steels which could cope with the drastic service requirements of ordnance materials, greatly accelerated research and development programs were necessitated. Although most metallurgists and designers are familiar with the NE specifications which were an important development of this period, much other research necessarily was carried out under a veil of secrecy. During the past two years, however, many of these secrecy restrictions have been removed and the accomplishments thereby have been made available for peacetime applications.

Considering first the developments during the war itself, the two most important were undoubtedly (1) the realization of the significance and importance of the hardenability concept and (2) the development of the "superalloys" for high-temperature service. The now familiar

THE VEIL OF SECRECY has been removed recently from many of the outstanding wartime achievements in the development of alloy steels. In this article are discussed some of these new steels and their significance to the designer. Included are "superalloy" steel for high-temperature service, age-hardenable stainless steel, alloy plate for built-up welded sections, low-alloy high-tensile steel, and steels designed specifically to retain toughness in low-temperature applications. All these noteworthy materials are expected to be applied widely in peacetime equipment. Also emphasized by the authors as most important is the growing trend toward extending the use of the hardenability concept for steel specifications

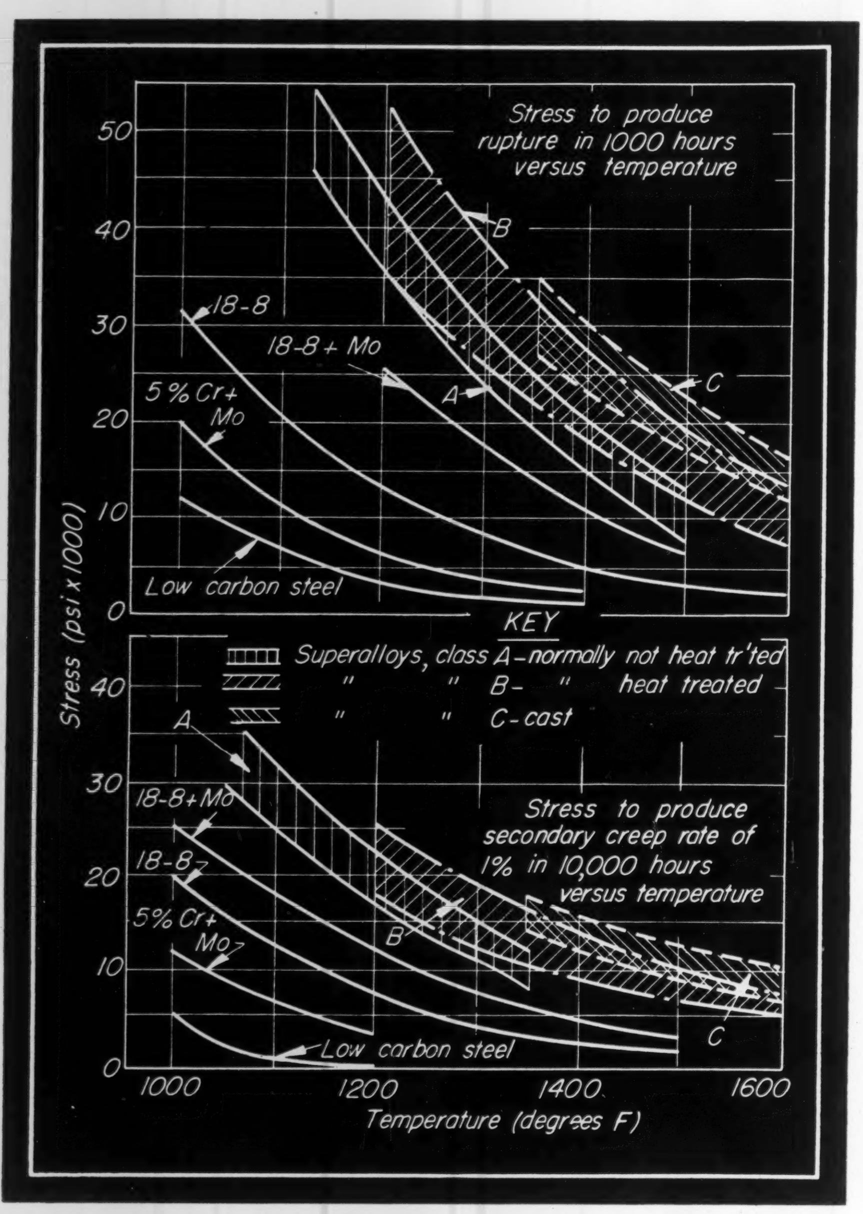


Fig. 1—Left—Comparative creep and stress-rupture values of superalloys and more common heat-resisting steels

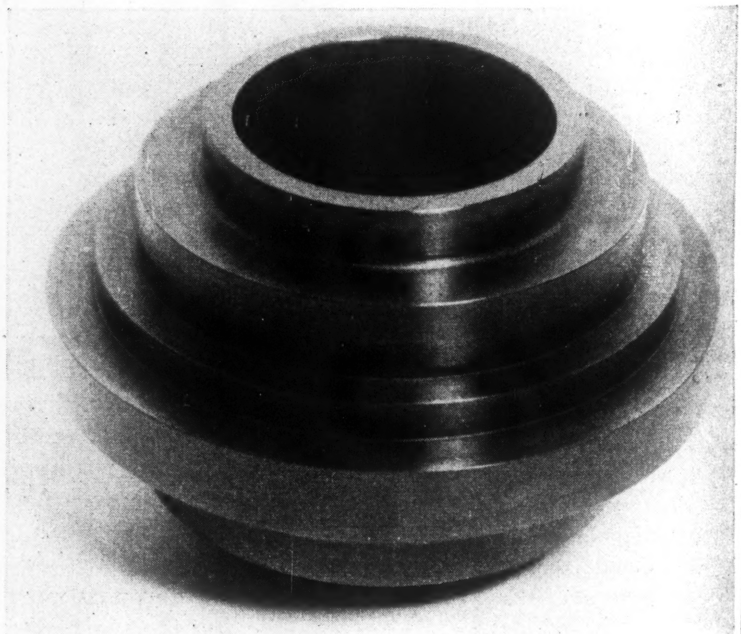
NE compositions are an example of the trend toward the application of the hardenability concept to metallurgical design which permitted rapid and efficient solution of the serious alloy conservation problem and which has continued to play an important role. Assurance of adequate hardenability was found to be the prime requisite to meet the requirements of ordnance service. Applications of this principle to the development of alloy steels for peacetime use have been recognized increasingly by metallurgists during the past two years.

Out of the research on alloy steels, necessitated by the many and rapid advances in aircraft design during the war years, has come the superalloys. These were developed to furnish necessary high strength at high temperatures. To a considerable extent, the veil of secrecy surrounding these important developments has been lifted during the past year. One application, the turbosupercharger, as discussed by Badger, (1)[*] calls for alloys having strength at elevated temperatures, for example, 1200 to 1350 F, and calls for service at still more elevated temperatures in gas turbines and jet engines.

In these fields, it already was known that high-temperature strength could be provided to a moderate degree by the use of chromium and nickel, as in the 18-8 combinations, but that additional elements were needed if the requirements in high-temperature strength were severe. These additional elements included molybdenum, tungsten, cobalt, columbium, vanadium and titanium, the preference being not necessarily in the order mentioned. The greater these high-temperature strength requirements, the greater in general was the amount of alloy needed, although the use of certain alloys in combination often was found to be more effective than a mere increase in percentage.

Of the alloy combinations which played prominent roles during the war, one was "Timken" alloy of 16 Cr, 25 Ni, 6 Mo which was used for moderate serv-

Fig. 2—Below—Heavy valve seat of stainless W, an age-hardenable stainless steel which offers corrosion resistance similar to that of 18-8 stainless steel



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[*] Numbers in parentheses refer to References at end of article.

ice such as turbosupercharger wheels; another was Vitallium, a cobalt-base alloy containing about 63 Co, 27 Cr and 5 Mo, which was used in more severe service, such as turbosupercharger buckets. Comparative creep and stress rupture values of these superalloys and some of the standard high-temperature steels as compiled by C. T. Evans, Jr. for American Society for Metals Symposium (2) on this subject are shown in *Fig.* 1. Research in these fields is continuing, although not quite on the same extensive scale and concentrated basis of the war years. Undoubtedly, many peacetime applications will be found where the design engineer seeks substantial strength at elevated temperatures. This field of research and development will certainly play an important role in the peacetime development of atomic power processes.

Other significant achievements of this period, which have been discussed during the past two years, include age-hardenable stainless steel and new construction techniques, utilizing built-up welded sections of alloy steels, as used, for example, in the construction of gun mounts.

Provides Strength in Heavy Sections

Age-hardenable stainless steel, called "stainless W", undoubtedly will be utilized in many peacetime applications. This steel is of the 18-8 group and contains aluminum and titanium. It is heat treated by quenching from an elevated temperature, followed by reheating in the range of 800-1000 F. The latter treatment provides the strength. Since the strength is provided in the reheating treatment, it becomes possible to provide high strength even in heavy sections and, of course, in complicated sections, whether heavy or not. It has a reasonable corrosion resistance of the order of the 18-8's. *Fig.* 2 shows a heavy valve seat made of this material.

Another development in the 18-8 stainless-steel field, which has now been disclosed, is a process for providing unusually low carbon contents, of the order of 0.025 per cent maximum carbon. This material makes it possible to apply 18-8 in applications such as welding, which in ordinary 18-8 would cause the presence of a zone susceptible to intergranular corrosion. Such intergranular corrosion previously had been avoided by adding to the 18-8 either titanium or columbium but, with the new steel, the use of the extra alloy is avoided except for a few cases where the corrosion conditions are of a special and unusual nature.

Developed Weldable Heat-Treated Steels

Welding techniques used extensively in the construction of ordnance materiel for building up structures from simple alloy steel plates or shapes produced weldments of high strength and toughness together with superior rigidity and lightness. Both low-alloy high-tensile steels and heat-treated alloy-steel plates and shapes were utilized during the war for this type of construction and compositions or both classes have been developed for specific use in this field. One peacetime application of such material has been in the manufacture of heavy-duty steam shovels for which the requirements in regard to strength, rigidity and lightness are particularly high. *Fig.* 3, which shows a part of a dipper for a large steam shovel, is illustrative of this type of construction. Heat-treated steels which have been used include those developed to meet the particularly severe requirements of armor plate, as well

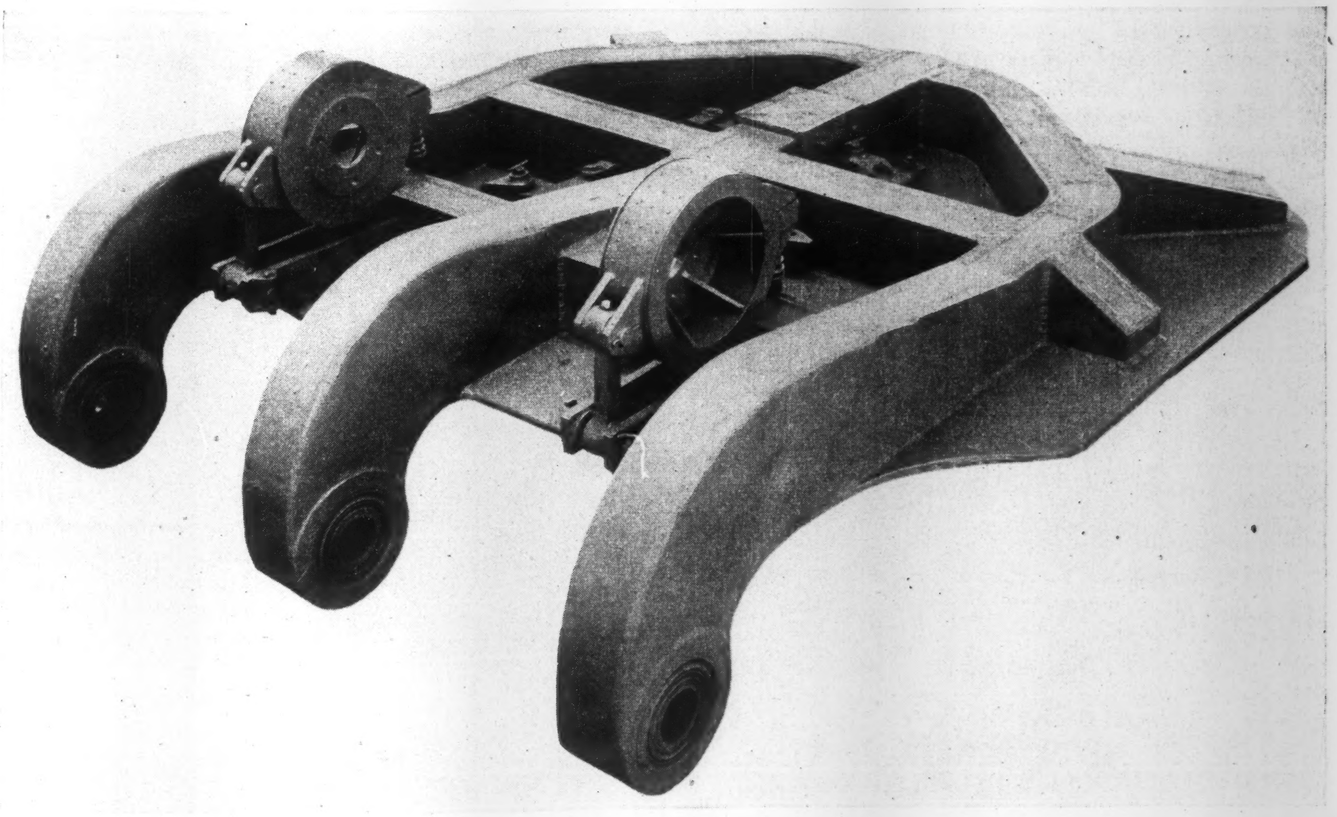

Fig. 3—Built-up welded alloy plate for the dipper back of a large Marion steam shovel provides lightweight structure of excellent strength and rigidity

Photo, courtesy Marion Steam Shovel Co.

as low-alloy high-tensile steels, modified to obtain higher strengths in the as-rolled or as-rolled and "stress-relieved" conditions.

Another wartime steel of a somewhat similar nature is a low-carbon nickel-molydenum steel corresponding to SAE 4608. This was developed as a high-strength sheet for airplane structures. Yield strengths of 100,000 psi are obtained by cold reducing, yet the steel can be spot welded successfully into airplane structures. The scarcity of nickel prevented extensive use of this steel during the war but it should make a useful addition to the list of peacetime alloy constructional steels.

Specification by Hardenability

One of the most significant contributions of the war years was the recognition of the importance of the hardenability concept. The trend during the past two years has been toward an ever-increasing application of this concept to the selection of steels for machine parts. Importance of this is based primarily upon the fact that the properties of a steel part are largely a function of its microstructure rather than of its specific composition. The microstructure that generally is associated with the most desirable properties (strength and toughness) in these steels is the fully hardened and tempered structure—tempered martensite. If the hardenability of a steel is such that this microstructure can be obtained under the given conditions of size and quenching rate, the user is thereby assured of obtaining these superior properties.

This concept was used in the development of the NE specifications and is being used by metallurgists and designers as a basis for the development of suitable steels for specific applications. Since there are many alloy combinations which can be used a furnish a desired hardenability, the choice of a composition may, therefore, be made on the basis of economy or availability. Thus, many peacetime designs will continue to make use of the NE steels. In other cases, special properties such as toughness or machinability under specific circumstances may incline the user to his favorite steel, whether it be an SAE or an NE steel. In any event, the current trend appears to indicate that probably half of the applications in these heat-treated alloy steels will continue with the triple-alloy types, with the remainder reverting to the SAE grades.

Understanding of the function of hardenability has led, naturally, to a demand for steels in which the hardenability is restricted to a specified range, being specified in terms of the Jominy or end-quench test. Fig. 4 illustrates one of these limited hardenability ranges, termed a "hardenability band." Steels sold to such a specification are known as H steels. It has been found possible to extend somewhat the customary overall chemical composition ranges for such steels and still stay within these hardenability specifications. The hardenability band illustrated in *Fig.* 4 is for the NE 8640 series of steels, which was the first series standardized by the committee of the American Iron and Steel Institute and consequently is the steel on which the most H-band experience is available to date. Experience with these steels has been highly satisfactory in providing uniformity, and the principle employed is being extended to other grades of steel. Selection and specification of steel on the basis of hardenability is distinctly to the advantage of the user in providing uniformity of processing while, at the same time, it enables the steel manufacturer to supply a product more suited to the needs of the fabricator.

Recent developments in alloy steels have, however, by no means been entirely confined to applications of wartime research. In spite of the difficulties associated with reconversion to a peacetime basis, research and development on peacetime applications of alloy steels has continued.

In the field of low-alloy high-strength steels, the trend is strikingly in the direction of wider applications. *Fig.* 5 shows a partially assembled all-welded hopper car, which by proper design, takes advantage of these higher strengths, providing not only a 16 per cent saving in weight, compared with standard design and carbon steel, but also a 5 per cent increase in cubic capacity. It is an example of good engineering design which takes advan-

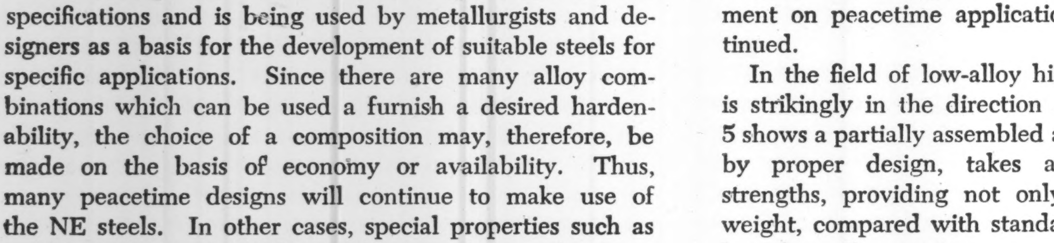

Fig. 4—Hardenability band for H-8640 steel. Current trend is toward increase of alloy steel specification by hardenability

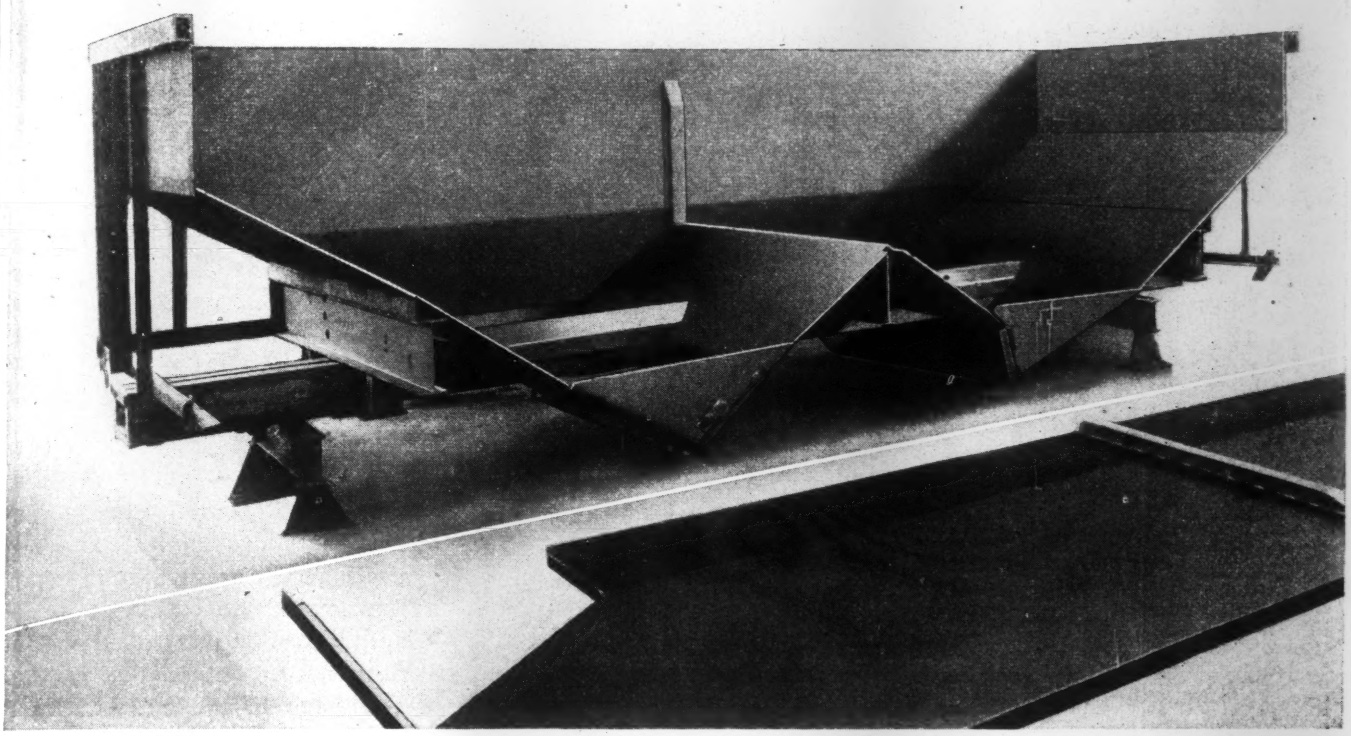

Fig. 5—Low-alloy high-tensile weldable steels are utilized in this partially assembled hopper car, permitting a 16 per cent reduction in weight compared to carbon steel

tage of the increased strength available in low-alloy steels.

Regarding these same high-strength steels, a trend which began sometime ago is becoming more apparent. At first, the entire philosophy was to furnish high strength with an improved degree of corrosion resistance. Latterly, many applications have arisen in which the welding requirement is paramount, and there is less accent on the improved degree of corrosion resistance. Consequently at the present time, there is a tendency to differentiate between application for high-strength steels, with some requiring the greatest available corrosion resistance under the circumstances and others requiring an especially good degree of weldability.

High-Strength Steel for Weldments

As mentioned, construction utilizing built-up welded sections has created a need for materials of even higher strengths than those of the common low-alloy high-tensile steels. Steels to meet these requirements have been, and are currently being developed. These include compositions in general similar to the standard low-alloy high-strength steels but somewhat more highly alloyed in which these higher properties are obtained after a "stress relieving" treatment, steels in which these properties are developed by age-hardening and steels designed to be quenched and tempered to these properties.

There is also an increasing trend toward the use of alloy steels as railway materials. For example, research and development is in progress, on the use of alloy steel for rails at locations where service conditions are particularly severe. Prewar experimentation is also being resumed on the use of alloy steel for locomotive boilers.

Another recent development has been that of a suitable and safe alloy steel for tubing used in steam power plants. Adequate high-temperature strength has been achieved in such steels by the use of 0.5 per cent Mo and the problem of possible failure, because of formation of graphite during service, apparently has been alleviated by the addition of a small amount of chromium to the molybdenum steel.

Still another field of development involves steels which retain their toughness at extremely low temperatures. Interest in this field covers a range from 0 to minus 260 F. There is generally no strength problem because the strength of steel increases as the temperature falls. The interest of designers centers on "toughness," as measured usually by means of a notch-bar impact test. For exceptional low-temperature toughness, the alloy steels, which at present seem most favorable, are those containing nickel, which generally is used to the extent of several per cent.

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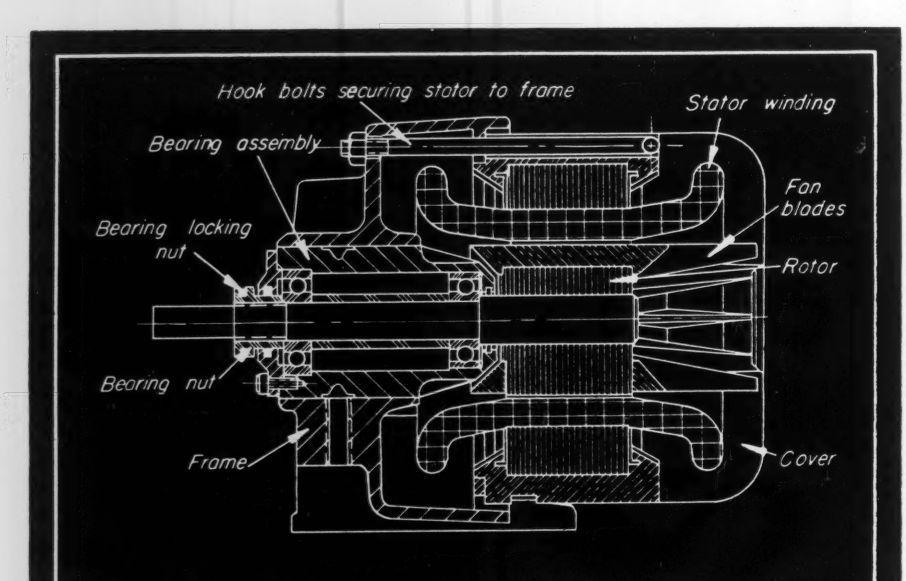
2. "Symposium on Superalloys for High Temperature Service", *Metal Progress*, July, 1946.

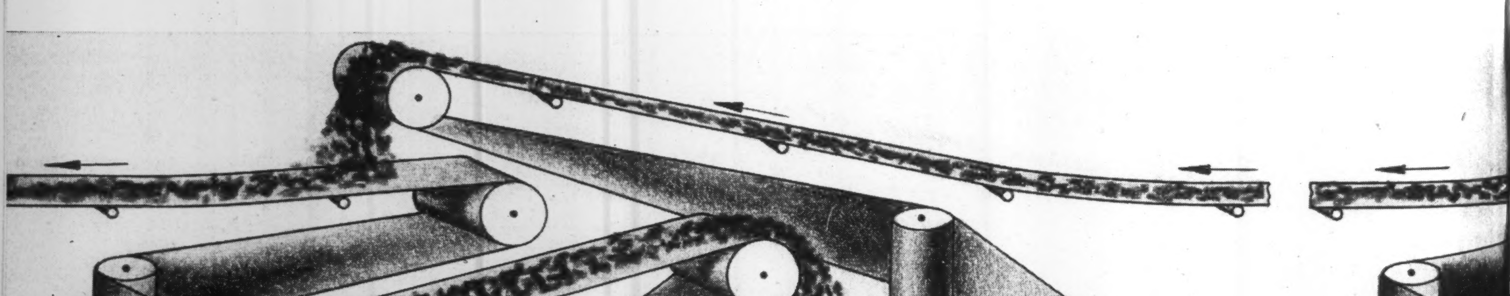
EXTENDING the inherent flexibility of mobile equipment to central station substations, General Electric Co. is now building fifteen trailer type units. Recognized as useful equipment on modern electric systems, this apparatus is not only for emergency service but also for use during maintenance or rebuilding of regular substations, system changeovers, relieving seasonal overloads, or supplying the power requirements of temporary loads. Three units are rated at 3000 kva, 33 kv maximum voltage. Style treatment is pleasing and serves to reduce cleanup time. Only necessary bushings and certain operating parts are exposed. All other equipment is concealed behind panels.

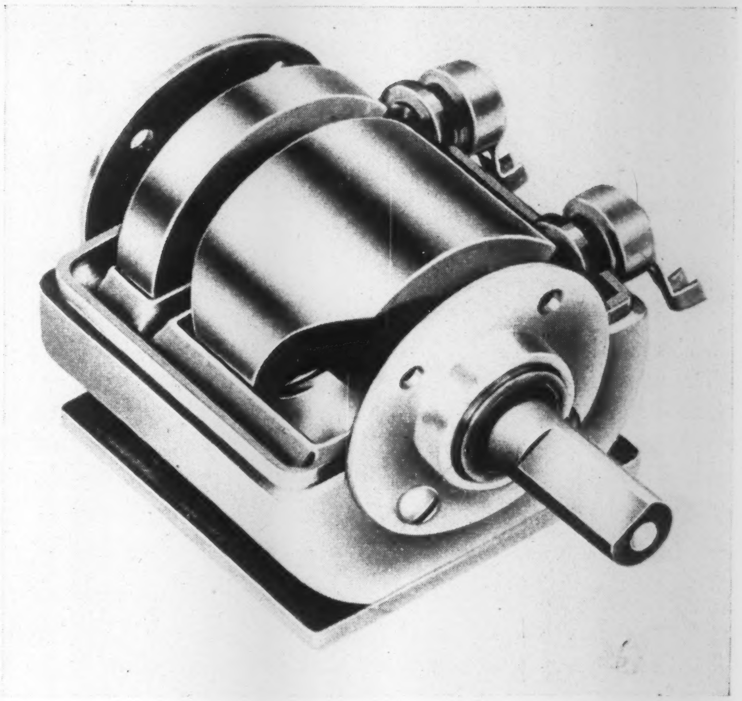
Scanning THE FIELD for Ideas


Hook bolts securing stator to frame
Stator winding
Bearing assembly
Fan blades
Bearing locking nut
Rotor
Bearing nut
Frame
Cover

DISMOUNTABLE motor, shown in sectional view above, reduces greatly the time required to replace parts or make a repair. Designed by Bomba Prat S. A. Badalona, a Spanish firm of manufacturers, the motor permits ready withdrawal of any of its component parts. For instance, should trouble develop in the stator, it can be withdrawn and replaced without dismounting either the rotor or bearings. Likewise the rotor and bearings may be withdrawn without affecting either the stator or frame.

In the sectional view the stator is shown mounted in the frame by means of hook bolts. Right end of this frame provides a seating for the stator, assuring its correct location. Cover is a press fit over the stator. Rotor, shaft and bearing assembly may be removed as a unit from either end. Design of bearing housing is such that once it is withdrawn it can be dismounted completely by removing a gland nut and cover. In size this motor is slightly longer than one of conventional design because of the overhanging bearing construction employed on the drive end of the shaft.



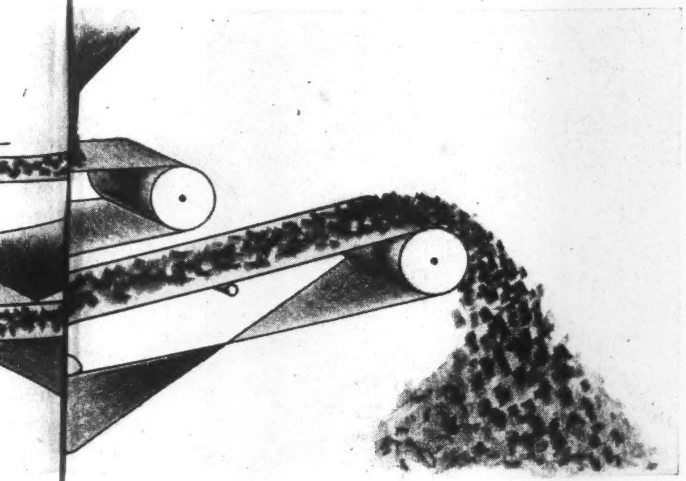


Barrel-cam rotor in a variable fluid condenser, shown at right with cover removed, provides a sturdy, sealed unit without many of the disadvantages of the multiple-plate condensers conventionally used in radio and other applications. Because of the mass of the solid rotor, acoustical feed back usually resulting from plate vibration is entirely eliminated.

Cams have precisely developed contours and areas and are mounted on a low-loss plastic shaft of sufficient rigidity. Stator is a pressure casting and is separated from the cam by fixed clearance increments. In this clearance is a synthetic fluid having a high dielectric constant, low power factor, and virtually constant viscosity throughout temperature extremes. Insulated terminals on the case are each connected to the rotor through a flexible lead. Base of the case serves as a common second terminal for the condenser.

Simplicity of construction and sealing provides a permanently adjusted assembly which cannot be jarred out of position. Electrical efficiency is about twice that for plate condensers and passage of much higher frequencies and volume is permitted.

Two-way conveyor belt, illustrated schematically below, employs the "return run" of the belt in such a way as to utilize continuously the top side of the belt. Any number of belt units may be employed, transferring at each end to the succeeding unit. This novel arrangement, designed by C. F. Smith of the Goodyear Tire and Rubber Co., uses two idlers between the end rolls of the conveyor loop to move the belt to position on the return run as well as turn the belt so that the same side of the belt is always carrying the materials being conveyed. In this way the clean side is always in contact with the rollers as in a conventional system. Developed for the steel industry where ore can be hauled in and slag taken out on the return run, the system is applicable for any installation requiring movement of bulk materials in both directions of travel.



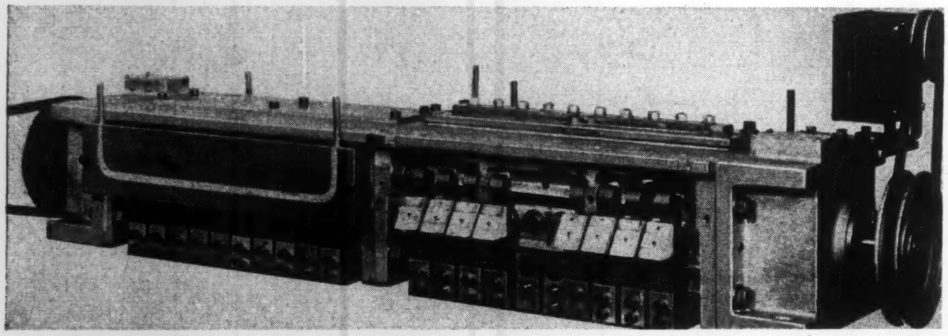
Test stand, below, also used as an assembly bench for aircraft propeller hubs, tests hydraulic functions of propellers. Operation of valves, pump, governor, and pitch mechanism are checked readily throughout 360 degrees of rotation. Designed by Hydraulic Machinery Inc., this stand has a welded-steel base with two oil res-

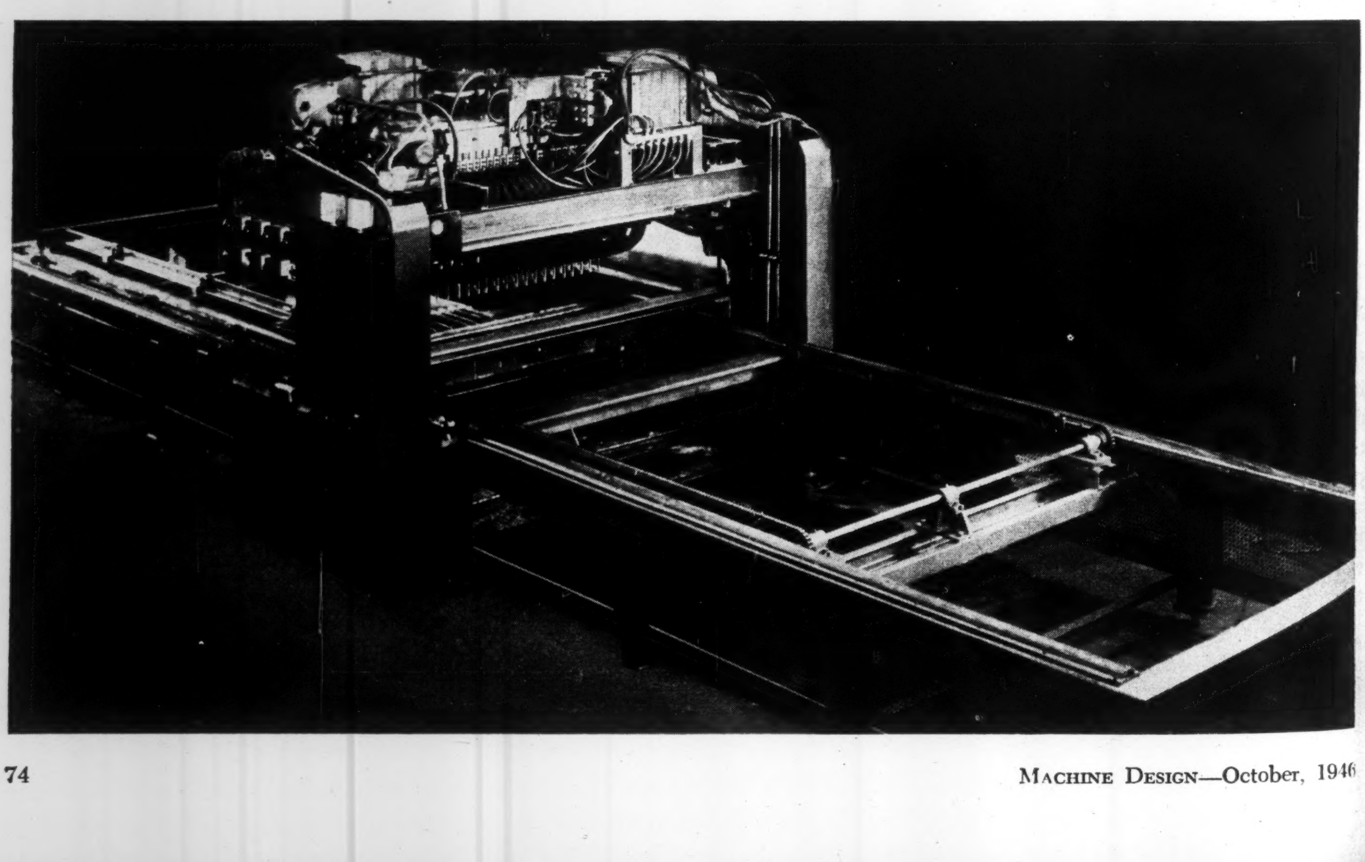
ervoirs built into it. Mounted on the base with adjustable leveling screws is a semisteel surface plate. Hub mounting adapter is located on the front end of this surface plate in a machined well. On the underside of the surface plate at the front end of the rig is a drive shaft and rotary seal gland. Drive is by V-belts through a fixed-stroke piston pump driven by a 10-hp motor, permitting infinitely variable speeds from 0 to 2000 rpm.

Function of the rotary seal gland is to transfer oil pressure from the rotating regulator through the regulator drive shaft and rotary seal and test head to the propeller hub sockets. This gland is fitted to close tolerances and is water cooled. Standard AN type O-rings are used for pressure sealing. Flexible water and hydraulic lines and a floating torque arm helps to eliminate side thrust and wear in this close-fitting high-pressure rotating seal gland.

Assembly of panels by automatic welding, is performed in 15 seconds for each group of 40 spot welds on the Progressive Welder Co. machine, below. Integral loading and clamping fixture, mounted on a horizontal carriage, moves into the machine at high speed under hydraulic power and automatically slows down and stops at first welding position within a tolerance of 0.01-inch. Welding guns come down and 40 series welds are produced. The guns raise while the carriage moves to the next position to repeat the operation until all the welds are completed. The carriage then moves through the machine to unload the assembly.

Programming is controlled by the unit at left, below. It distributes welding current to each welding tip successively by means of a screw-driven carriage that depresses push rods to engage each contact. At the same time another element on the carriage engages adjustable stroke plungers to control individually the length of time that welding current flows for each spot. All welding tips bear on the work simultaneously under welding pressure during the entire operation, eliminating separate squeeze and hold periods for each weld. Simple cams interposed between the tappets actuating the contacts assure the complete opening of each welding circuit before the next can be closed.





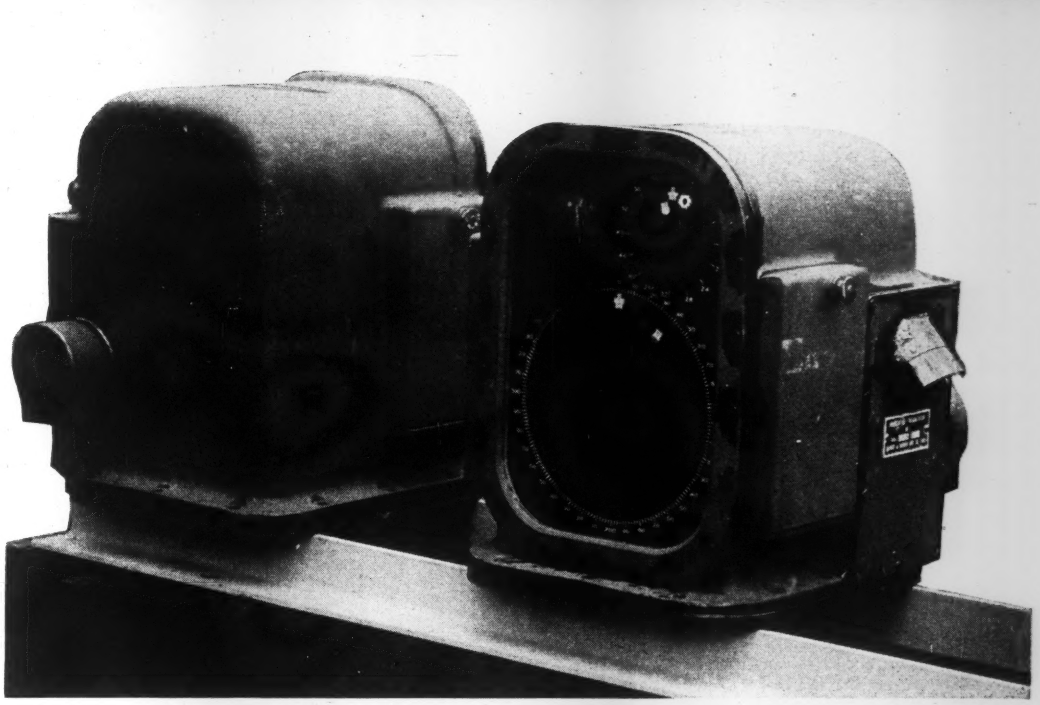


Fig. 1 — Right — Typical breather applications in army gun position indicators. Shield is placed over breather to keep direct rain from interior

Breathers

. . . are a convenient means of cooling machines, but should they be used in outdoor machinery or in the housings of delicate mechanisms?

By Arnold Raines and J. H. Rosenbloom

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MOST machines, intentionally or unintentionally, incorporate breathers. If the design is intentional as in *Fig.* 1, it is conceived as a means of voiding moisture and thus reducing the possibility of corrosion and other deleterious effects resulting from moisture. Moisture elimination will not be attained by solar exposure alone as will be demonstrated later. There are, however, several possible methods of reducing moisture accumulation. Use of silica gel is one of the better known. A double-wall housing to reduce heat loss and consequent in-breathing is also helpful. A third and new method—Plastic Seals—will be discussed in a forthcoming issue.

When used out of doors, machines accumulate condensed moisture on internal parts even though not exposed to rain. This occurs because through design or necessity the machine is not vacuum

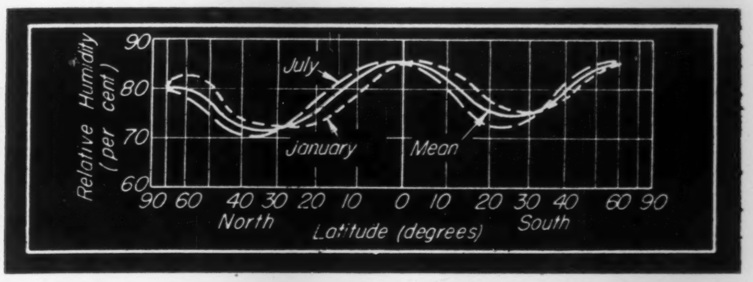

Fig. 2—Right—Zonal distribution of relative humidity—from Climatology by Haurwitz and Austin. Humidity increases with seasonal heat and decreases at the temperate zones. Machines should be designed taking these facts into consideration

sealed. Breather systems involve the suitable placement of orifices in the outer shells of equipment to prevent the condensation of vapor within, or to hasten its evaporation once condensed. This is intended to be accomplished by induction of greater air motion within the housing. For air layers immediately next to the surface of condensed moisture, the water vapor pressure will be greater than for layers at a greater distance. By the motion of air of lower relative humidity, an air mass exchange takes place between the immediate layers and the moving air, causing a more rapid evaporation. The breather is supposed to cause the greater air motion by taking advantage of outside winds or solar heating of the upper parts of the machine to a greater extent than the lower parts. It will be shown that unless the outer shell is of a very specialized shape, solar exposure will not increase air motion.

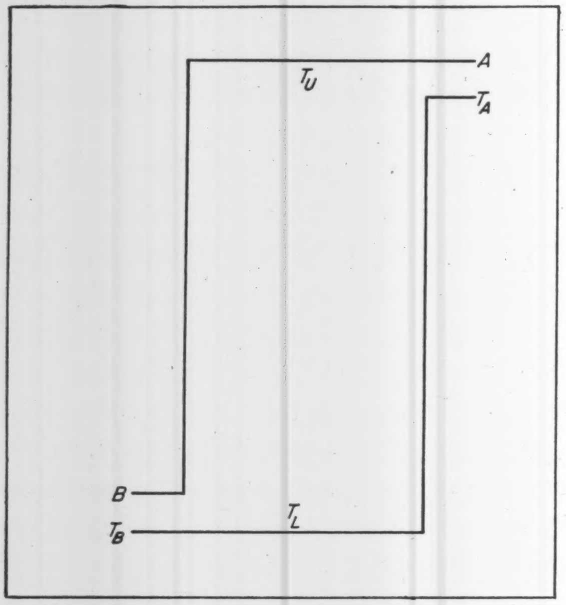

Fig. 3—Above—Schematic of breather with assumed disposition of temperatures indicated

To evaluate the efficiency of moving air in evaporating from a horizontal surface of water, the following formula from Marks Mechanical Engineers Hand Book for the rate of evaporation is applicable:

$$W=0.093\left(1+\frac{V}{230}\right)(e'-e)$$

where W = mass of water evaporated in lb/sq ft/hr, $e' - e$ = difference in saturation pressure and observed pressure of the water vapor at observed temperature in inches of mercury, V = velocity of air parallel to water surface in ft/min. If the direction of the air current is normal to the surface, then W is approximately multiplied by 2.

From *Fig.* 2 it can be seen that the average relative humidity for the world is about 75 per cent, so that at 80 F, $e' - e = 2$ in. of mercury. Thus, in still air $W = 0.02$ which from a practical standpoint is a negligible quantity. From the above, it follows that for an air velocity of $3n$ mi/hr the rate of evaporation is increased approximately n fold. Thus, from a practical standpoint, the ordinary available atmospheric velocities will not make the breather as conceived an efficient evaporator.

Finally, at the very best, a breather can assure that the relative humidity of the air inside the shell will be the same as atmospheric, which for the tropics, as can be seen from *Fig.* 2 has an average value of 85 per cent, and therefore an even greater value for a significant portion of the time.

Returning to the induction of air motion due to solar heating, consider a container as outlined in *Fig.* 3 with a constant decrease in temperature downward along the solid. There will be a similar temperature gradient of the air inside, except near the orifices. Let T_A = temperature of the outside air near the opening A, T_B = temperature of the outside air near the opening B, T_U = temperature of the upper portion of the container and the surrounding inside air, T_L = temperature of the lower portion of the container and the surrounding inside air. Then due to the greater specific heat of the solid

$$T_A<T_U \qquad (1)$$

At the beginning of the sun's action

$$T_B>T_L \qquad (2)$$

Eventually

$$T_L>T_B \qquad (3)$$

when the effect of the heat conduction through the solid becomes pronounced.

Evaporation of the water vapor can occur by the following three methods:

1. An increase of the temperature of the air near the condensed moisture, thus raising the saturation pressure
2. A net outflow of water vapor due to diffusion transport as considered in kinetic theory of gases
3. A net outflow of water vapor due to a moving air current near the condensed moisture.

The distinction between methods (2) and (3) is that the latter involves mass motion and is consequently a problem in fluid dynamics while the former is concerned with the deviation of the molecules from the average motion. It may be noted that the only flows under consideration are those due to the temperature caused by the sun; outside winds having been considered previously.

Increase of temperature near the condensed moisture in the lower portions, *Fig.* 3, can occur by heat conduction and the flow of warm air. Since $T_A<T_U$, orifice A is a disadvantage, while orifice B will be an advantage only during the period when $T_B>T_L$ as far as heat conduction is concerned. In general, the effect of heating by conduction at B will be small in comparison to the heating due to the mixing of the inside and outside airs at B because of ordinary atmospheric circulation. The existence of flows will be considered in the following:

From the kinetic theory of gases the general equation of diffusion for a binary mixture, from Chapman and Cowling —*Mathematical Theory of Non-Uniform Gases* is

$$\bar{e}_1-\bar{e}_2=-\frac{n^2D}{n_1n_2}\left[\frac{\partial n_1/n}{\partial r}+\frac{n_1n_2(m_2-m_1)}{n\rho}\,\frac{\partial \log p}{\partial r}-\frac{\rho_1\rho_2(F_1-F_2)}{p\rho}+\frac{k_T\,\partial T}{T\,\partial r}\right] \qquad (4)$$

where $\bar{e}$ = molecular velocity, n = number of molecules per unit volume, m = mass per molecule, p = pressure, ρ = density, F = external force/m, T = temperature, D = coefficient of mutual diffusion, $k_T = D_T/D$ where D_T = coefficient of themal diffusion, r = space vector (our problem is assumed one dimensional when referred to the mass properties). Subscripts differentiate between the component gases. No subscript refers to mixture as a whole. Dash above a symbol indicates an average.

To apply the above formula, subscript 1 will refer to the water vapor, and for simplicity the other components will be combined under subscript 2. On the right hand side of Equation 4, the terms in numerical order respectively indicate diffusion due to the concentration gradient, the pressure gradient, different accelerative effects on different components, and the thermal gradient. Since F is the acceleration due to gravity, $F_1 = F_2$. Diffusion due to the pressure gradient is negligible. If m_1 is nearly equal to m_2 and $\sigma_1 > \sigma_2$ where σ is the radius of a molecule—as is true for water vapor when compared to the chief components of air, nitrogen and oxygen, $k_T > 0$ unless the gas is ionized. This means, from Equation 4, that due to the gradient the water vapor diffuses into the colder region.

Thus, a concentration gradient will result with diffusion in the opposite direction. To see what happens eventually, consider Equation 4 under equilibrium conditions when $\bar{c}_1-\bar{c}_2=0$. It is thus reduced to

$$\frac{\partial(n_1/n)}{\partial r}=-\frac{k_T\,\partial T}{T\,\partial r} \qquad (5)$$

where k_T is a negligible function of T, but a significant function of n_1/n. However, since n_1/n will vary at most between 0 and 0.04, k_T can be approximated by kn_1/n where k is a positive constant. The final solution then becomes

$$\frac{n_1}{n}=\frac{h}{T^k} \qquad (6)$$

where h is a positive constant. Thus, the water vapor accumulates to a greater extent in the colder region, which is opposite to what is wanted!

Mass flows are due to pressure gradients or external forces such as gravity. In the case at hand gravity is opposite to the desired direction to cause flow, since $T_U > T_L$. An effective flow for evaporation would be a unidirectional current between the orifices A and B of *Fig.* 3 and inside the container. From the existence of a downward, decreasing temperature gradient and the notation above, it will be recalled that at first

$$T_U > T_L,\quad T_B > T_L,\quad T_U > T_A,\quad T_U > T_B,\quad T_A > T_B \qquad (7)$$

and that eventually

$$T_U > T_L,\quad T_L > T_B,\quad T_U > T_A,\quad T_U > T_B \qquad (8)$$

At equilibrium, if $T_1 > T_2$ then at constant volume $P_1 > P_2$ (where P is the pressure). But for transient case—as the one under consideration—the pressures can not be determined from the temperatures but will depend upon the previous history of the air masses. Thus, all the various possibilities, as to the relative pressures will be considered.

To obtain the required unidirectional flow, there must be an outflow at one orifice and an inflow at the other. Then, it will be assumed that within the container a warm air mass in colder surroundings will rise to a layer of equal temperature. Conversely, cold air in warmer surroundings will fall to an equal temperature layer.

When Equation 7 governs, an inflow of air at B will rise through a portion of the height of the container since $T_U > T_B$, and thus an outflow at A will not complete the circuit started at B. A similar situation will occur when the inflow is at A, since $T_A > T_L$. When Equation 8 governs, the nonexistence of the flow follows as before except when $T_L > T_A$, and there exists an inflow at A and an outflow at B.

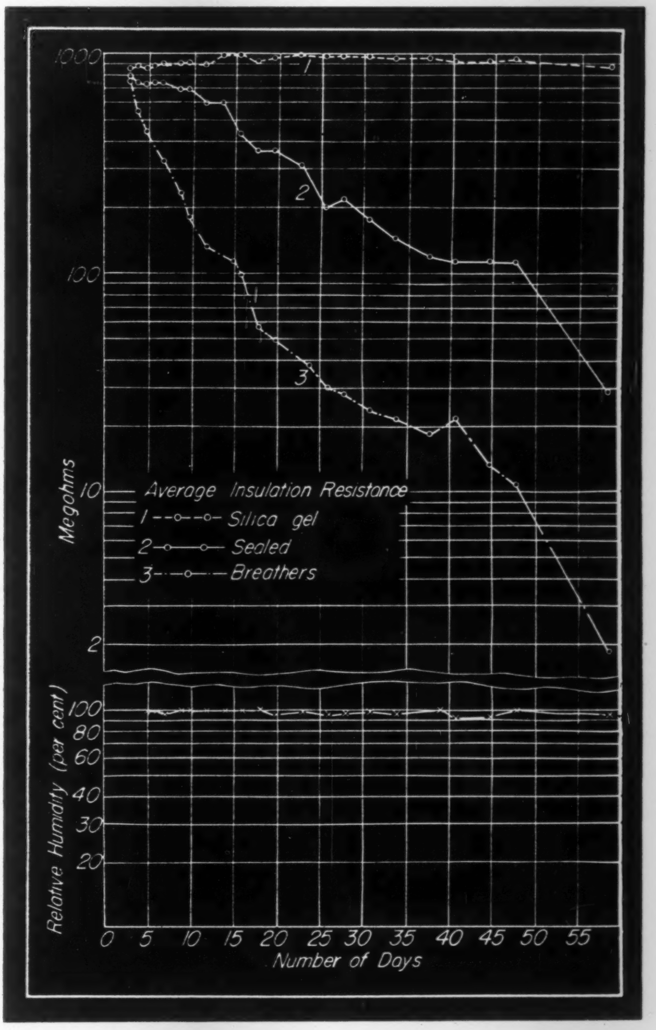

Fig. 4—Above—Result of tests on humidity control methods. Breather is observed to be worse than no precaution at all

However, there are difficulties in maintaining this latter flow, which requires that $P_A > P_U$ and $P_L > P_B$. If the atmosphere is near equilibrium, $P_A = P_B$. Thus $P_L > P_U$. However, if the portions of air in the containers are also near equilibrium, $P_U > P_L$ since $T_U > T_L$. Hence, the possibility of inducing an airflow through the container be-

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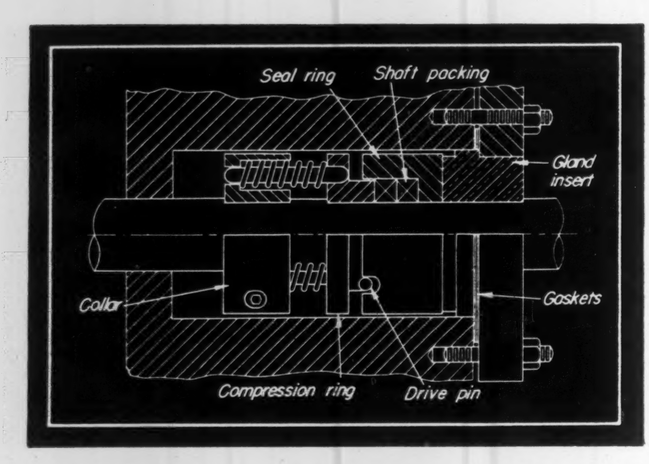

Fig. 7—Inside assembly seal. Pressure drop across the faces is radially inward. Seal is of packing-ring, gasket, helical-spring type

Mechanica

By Douglas R. Lewis
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ALL mechanical seals consist basically of a rotating surface, a stationary one, and some means of keeping them in intimate contact. If the rotating surface is not part of the shaft itself it must be fastened to the shaft with a fluid-tight joint, and if the stationary surface is not part of the casing itself it also must be fastened with a fluid-tight joint. The manner in which these joints are made, and the means adopted to keep the faces in intimate contact offer a convenient scheme for classifying the various types of seals now on the market as items separate from the equipment in which they are used.

Joints between the rotating member and shaft, at present, are made by (1) a slidable packing ring which functions somewhat like a piston ring, (2) a metal or rubber-like bellows, or (3) a gasket. Joints between the stationary member and the casing also utilize packing rings, bellows, or gaskets. And the intimate contact between the faces is maintained by a helical spring or springs, or by straining a thin section of some elastic material. There are, therefore, eighteen possible arrangements.

Many Variations Are Possible

Each of these arrangements may be subdivided according to whether the pressure drop across the faces is radially inward or radially outward. The resulting combinations may be subdivided further according to whether the axial takeup motion made necessary by wear or shaft end play is provided by the rotating member or the stationary one. Some of these, in turn, may be classified depending on whether there is one helical spring or more than one, and whether the seal is cooled or lubricated. Such variations, however, are usually obtainable by modification of the eighteen basic arrangements mentioned previously. It is suggested, therefore, that mechan-

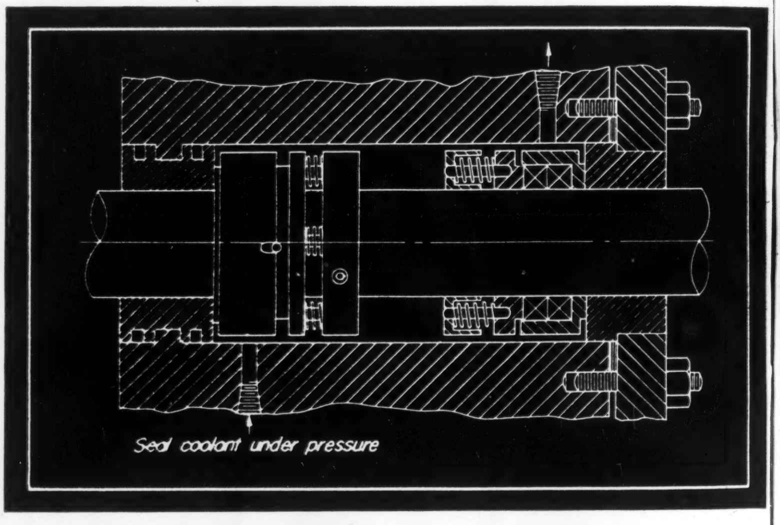
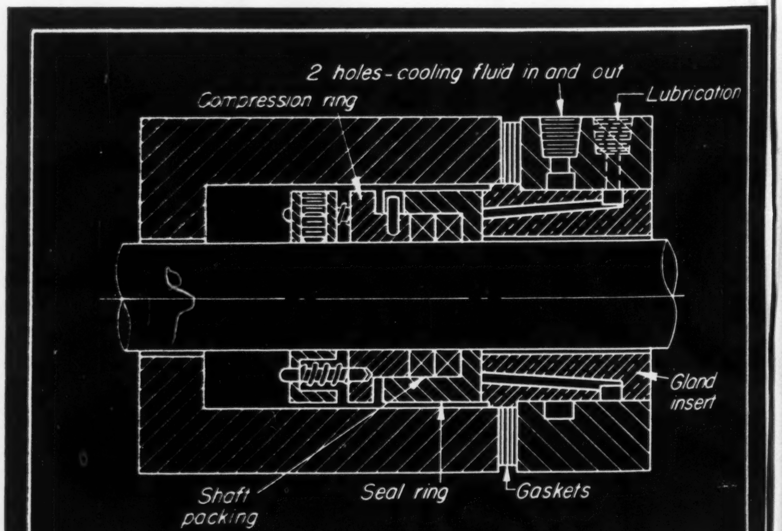


Fig. 8—Above—Double seal utilizing design shown in Fig. 7. Coolant is circulated at a pressure near that of the sealed medium

Fig. 9—Below—For fluids difficult to contain, this seal utilizes forced lubrication and coolant. Required catch basin for oil leakage is a limitation of the seal design



caSeals

Part II—Classification of Types

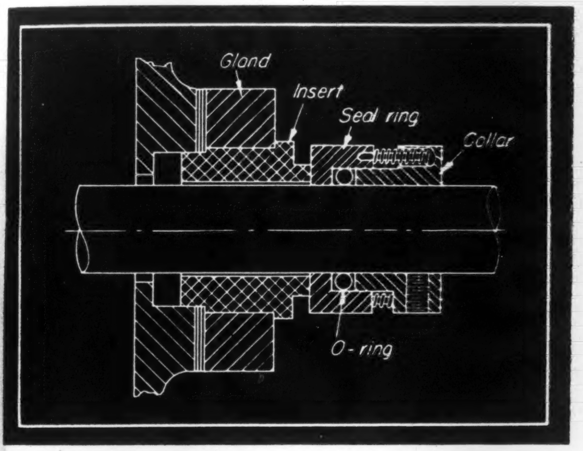
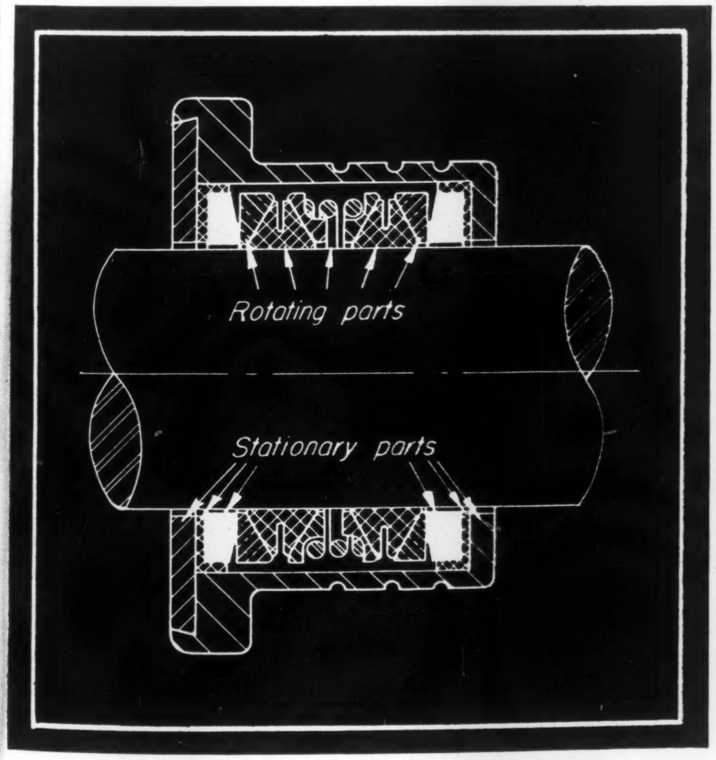


Fig. 10—Above—Useful in limited space, this outside-assembly seal employs O-ring, obviating a compression ring in the design

Fig. 11—Below—Double seal of packing-ring, gasket, helical-spring type does not require circulation of fluid under pressure between seals



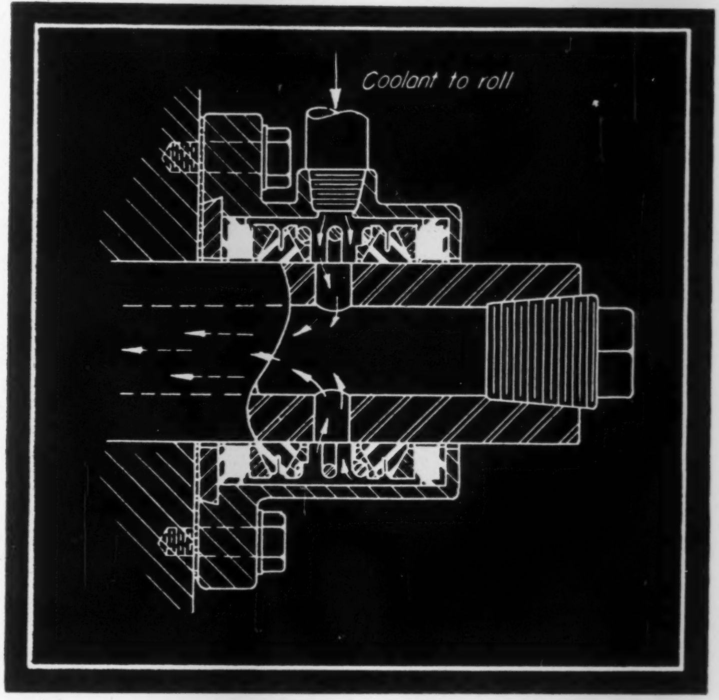


Fig. 12—Rotary joint for flow through hollow shaft utilizes seal shown in Fig. 11 to provide inexpensive, easily replaceable units

ical seals be classified by reference to (1) the rotating joint, (2) the stationary one, and (3) the means of securing the unidirectional force necessary to keep the faces in intimate contact.

A mechanical seal of the packing-ring, gasket, helical-spring type is illustrated in *Fig.* 7. In the style shown the pressure drop is radially inward across the faces, and is known as an "inside" assembly. However, if the rotary member is placed on the zero or low-pressure side of the stationary member, the seal becomes an "outside" assembly in which the pressure drop is radially outward across the faces. In the inside assembly the fluid pressure helps to keep the faces together, and it is capable of sealing much higher pressures than the outside assembly, where the fluid pressure does not aid the springs. The seal is available in a great variety of materials and is made to fit particular dimensions. It is, however, comparatively expensive, being made to individual requirements, rather than in standardized sizes.

Double Seal Employs Coolant

When two of these seals are used, *Fig.* 8, one in each end of a stuffing box, and oil or some other lubricant and coolant is circulated through the box between them at a pressure equal to or slightly higher than the pressure to be sealed, the arrangement is known as a "double" seal. This interposes a fluid cork between the sealed material and the atmosphere, and offers the further advantage of a means to control, within limits, the temperature surrounding the seal. If the circulating fluid is oil or some other fluid easy to seal, high pressures can be handled.

A double seal arrangement suffers the considerable disadvantage, however, of requiring a sealing-fluid pressure and circulating system—usually a separate

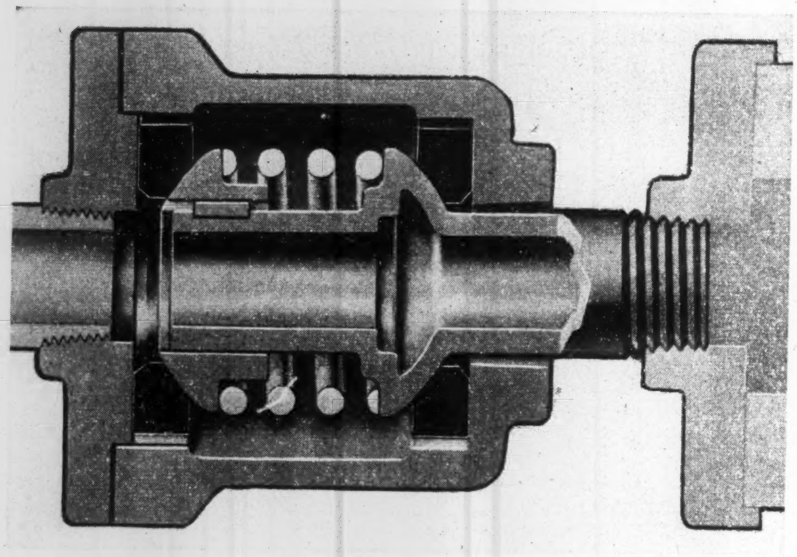


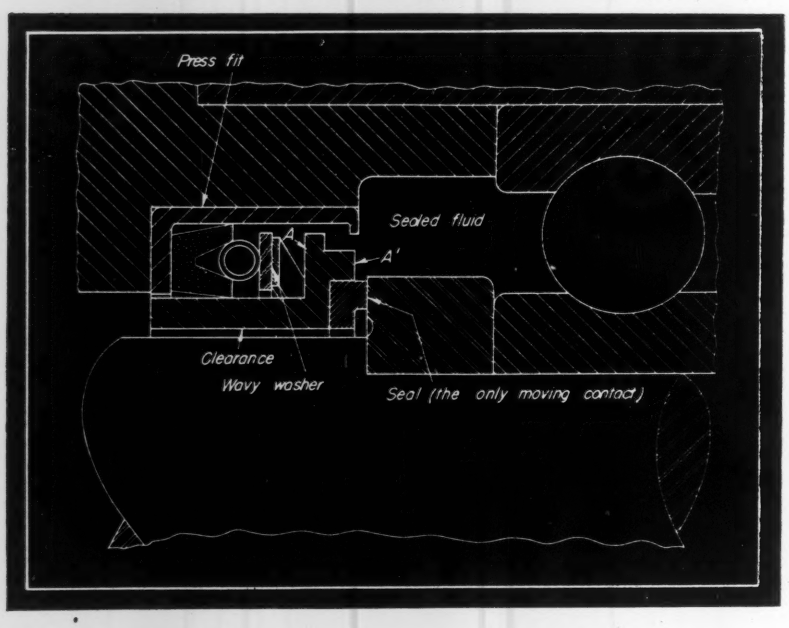
Fig. 13—Joint is obviated in this design in which rotating sealing surface is a flange on the shaft

pump and driver with a tank, cooling coils and other auxiliary equipment.

An arrangement of this type of seal which can be used with pressures up to about 500 psi for fluids which are difficult to seal, such as propane, is shown in *Fig.* 9. In this type, oil is forced between the faces by means of a small lubricator of the plunger type. The disadvantage is that the amount of oil forced between the faces, usually about five drops a minute, comes out between the shaft and gland insert, and requires a drip basin or other means of conducting the leakage away. Also, a small amount of the product being sealed escapes with the oil, which may be objectionable.

Shown in *Fig.* 10 is a recent development of this type of seal, arranged as an outside assembly. An O-ring is used in place of the packing ring or rings and, since it need not be compressed mechanically, the compression ring is eliminated. Such a seal is particularly useful where space is limited.

Fig. 14—Spring washer both loads the chevron packing in stationary element and holds stationary surface of sealing member against rotating face. Only one moving contact is employed



Another type of packing-ring, gasket, helical-spring seal is shown in *Fig.* 11. This is made as a double seal, but it is not necessary to provide circulation of a sealing fluid under pressure between the seals. Usually obtainable in stock sizes for shafts from ¼ to 24 inches, the seal is useful for pressures up to 250 psi. With special construction it can be adapted for even higher pressures. The temperature range for general use is between −50 and 300 F. The type is not recommended for fluids carrying abrasive particles, or for fluids which crystallize or solidify on exposure to air or reduction in temperature. These seals are used at speeds up to 3000 surface feet per minute measured at the seal faces. A small amount of misalignment between the shaft and surface to which the seal is fastened on the casing is not objectionable.

Large numbers of this type of seal were used on propeller shafts of shore craft during the war. They can be applied to pump shafts and other rotary equipment in either vacuum or pressure service. In an unusual application, shown in *Fig.* 12, one is used as a rotary joint on a hollow, rotating shaft. The seals are comparatively inexpensive, and have the distinct advantage of being in one piece and easily replaceable.

Shaft Flange Obviates Joint

Illustrated in *Fig.* 13 is a seal in which the rotating sealing surface is part of the shaft itself, making a joint unnecessary. For classification purposes it might be termed an integral, gasket, helical-spring seal. The threaded connection between the nipple and the rotating roll or drum makes for easy assembly, and is not part of the seal in a functional sense. Sealing takes place between the concave spherical surface of the carbon-graphite ring and the convex spherical surface of the flange on the nipple. A thrust collar, spring loaded against a similar ring, is locked to the nipple and driven by a key. The sealed fluid enters the spring chamber by way of the fit between the nipple and collar and aids the spring in forcing the sealing faces together. Thus sealing force naturally increases as the fluid pressure increases.

This seal is not affected by slight lateral misalignment or sudden lateral motion and is used extensively for systems requiring internally steam-heated or water-cooled revolving rolls or drums. It is standard equipment on most paper and textile machinery such as slashers, dry cans, sanforizers, and calenders, and is finding increasing application in rubber mills and cold-strip steel mills.

Rotating member for the seal shown in *Fig.* 14 may be part of the shaft itself, or it may be a ring which is pressed, welded, or otherwise made tight and integral with the shaft. The classification would be integral, packing-ring,

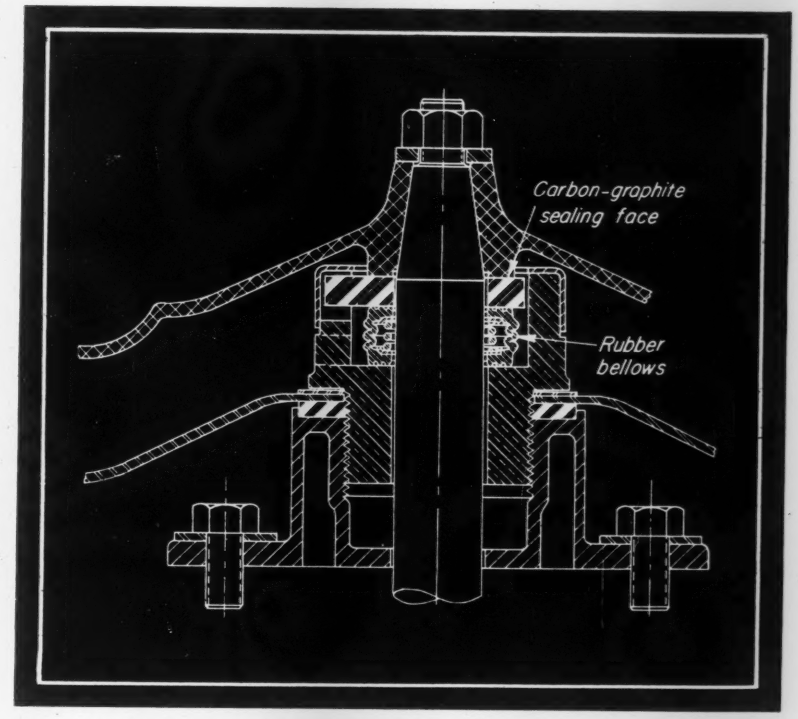


Fig. 15—No torque is transmitted through bellows in seal. Sealing member is carbon-graphite ring with ears to engage slots in housing

strained member. The strained member is a spring of the wavy washer type, which performs the double function of expanding the chevron packing ring and forcing the stationary sealing surface against the rotating one. Area *A* is greater than area *A′* by an amount which is intended to provide the correct face load increment for a corresponding increment in pressure of the sealed fluid. Fluid pressure also helps the spring to expand the packing ring, increasing the sealing pressure between the seal ring and retainer cup as the working pressure increases.

This seal is made in stock sizes for shafts from ¼ to 4 inches in diameter, and for larger sizes on special order. The rotating member is not supplied by the seal manufacturer. The seal is recommended for vacuum work and for pressures up to 1000 psi. Its temperature range is from −65 to 450 F. It is not intended for use with fluids carrying abrasive particles or which will solidify or crystallize in the seal parts.

Ears Prevent Torque Transmittal

Seal assembly shown in *Fig.* 15 may be used either as a rotating member or as a stationary member. Usually its companion piece is not supplied by the seal manufacturer and is a part of the casing or a part of the shaft, depending on whether the assembly does or does not rotate. It may therefore be considered a bellows, integral, helical-spring seal when it rotates, and an integral, bellows, helical-spring seal when it does not.

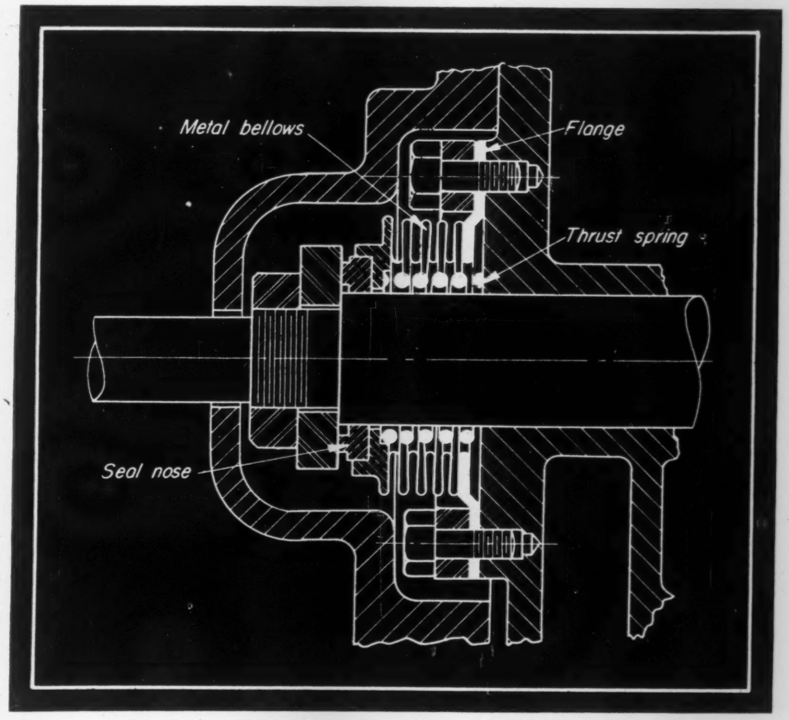
Sealing face for such a seal consists of a carbon-graphite washer with two or four ears which engage slots in the machine part which contains the seal. The spring assembly consists of a low-rate helical spring in a telescopic-metal retainer, all of which is enclosed in a synthetic-rubber bellows. Each end of the bellows presents an annularly corrugated face which, when pressed by the spring against the carbon washer on one end, and an appropriate face on the shaft or casing on the other, acts as a gasket with a high degree of flexibility. The carbon washer and the spring assembly turn or remain stationary together, but no torque is transmitted through the bellows.

Permits Large End Play

The seal is also made so that one end of the bellows seats on the shaft, in which case the spring is outside the bellows. All types are made in stock sizes for shafts from 7/16 to 1-7/16 inches in diameter. Applications are usually in low-vacuum and low-pressure service, in the neighborhood of 15 psi, and temperature limits are from 40 to 250 F. Presence of abrasive particles in the fluid to be sealed does not preclude their recommendation but they are not offered for fluids which solidify or crystallize, or have low n-value and high vapor pressure such as propane. They are of particular value where end play up to ½-inch might occur, and they have wide application in automobile, truck, and tractor water pumps, as well as in tanks, aircraft, and shipboard. Their ease of installation is a noteworthy feature, no adjustment or tightening being necessary.

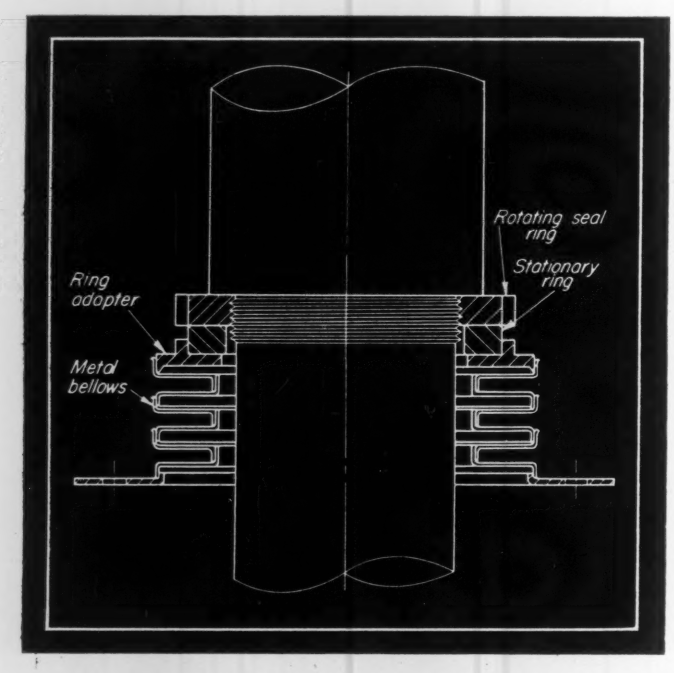
Same theoretical seal design is shown in *Fig.* 16, except that the

Fig. 16—Metallic bellows replace synthetic rubber in seal to give greater strength to unit. Helical springs usually are employed to give desired pressure on seal nose



bellows is metal instead of synthetic rubber. As might be expected, such a change offers advantages and disadvantages. What is sacrificed in flexibility is gained in greater strength and variety of materials. Like the synthetic rubber bellows type, they are usually supplied without the companion sealing face, and the spring section may or may not rotate. Pressures up to 250 psi are not unusual, and the bellows and other parts can be furnished in a fairly wide choice of corrosion-resistant alloys. Seals of this type must be selected with great care, since a bellows has an effective area which, under the fluid pressure, may increase or decrease the face load depending on whether the pressure is external or internal in relation to the bellows, and on the ratio of bellows effective area to seal contact area.

Bellows seals are almost always used with a helical spring, since the bellows itself has little natural spring. A seal of the same classification, but employing a different type of bellows is shown in *Fig.* 17. The bellows consists of a stack of flanges rimmed in opposite directions on their inner and outer edges, and welded together alternately on these inner and outer rims. This produces a bellows which has a definite spring rate, each flange acting as a Belleville washer or spring. By varying the inside and outside flange diameters and the metal thickness, the bellows can be designed to act as its own spring. A seal based on such a bellows would be of the strained-member type.



g. 17—Natural spring is built into bellows by welding stack of flanges to effect series of Belleville springs, eliminating the usual helical spring. Wide choice of bellows materials is available with this construction

Another advantage of this type of bellows is that it can be made of "hot short" alloys, since deep drawing or forming is not necessary as in the conventional type. Seals using them can be made for any size shaft, and, in this case, the manufacturer supplies the companion piece. All seals are made to special order, for high vacuum up to 600 psi, and for temperatures from -80 to 500 F. Whether they can be used in fluids carrying abrasive particles depends on the type of abrasive, but they are not recommended for fluids which might solidify or crystallize around seal. They can be supplied for light end service to handle fluids such as propane and refrigerants, and are available in various alloys suitable for speeds up to 11,000 rpm.

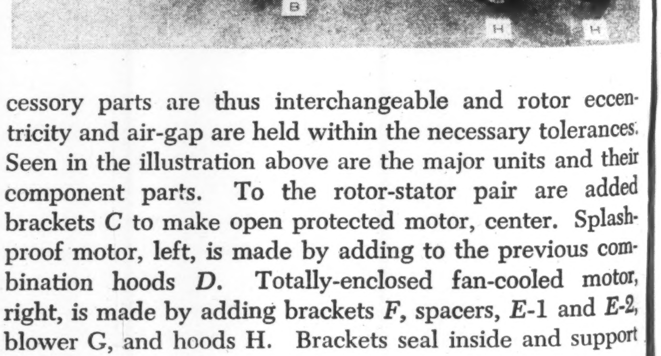
Seals discussed in this article are those in common use today. As pointed out earlier, there are many variations, but, if the characteristics of the basic types are recognized, it is not difficult to make a fair preliminary evaluation of their variations for a particular service or use. The answer to a specific problem, however, might be something that does not appear in any catalog, since all variations would be difficult to list. It is even possible that the solution may involve a variation which has never been tried before. For this reason succeeding articles in this series will discuss practical applications and theoretical design.

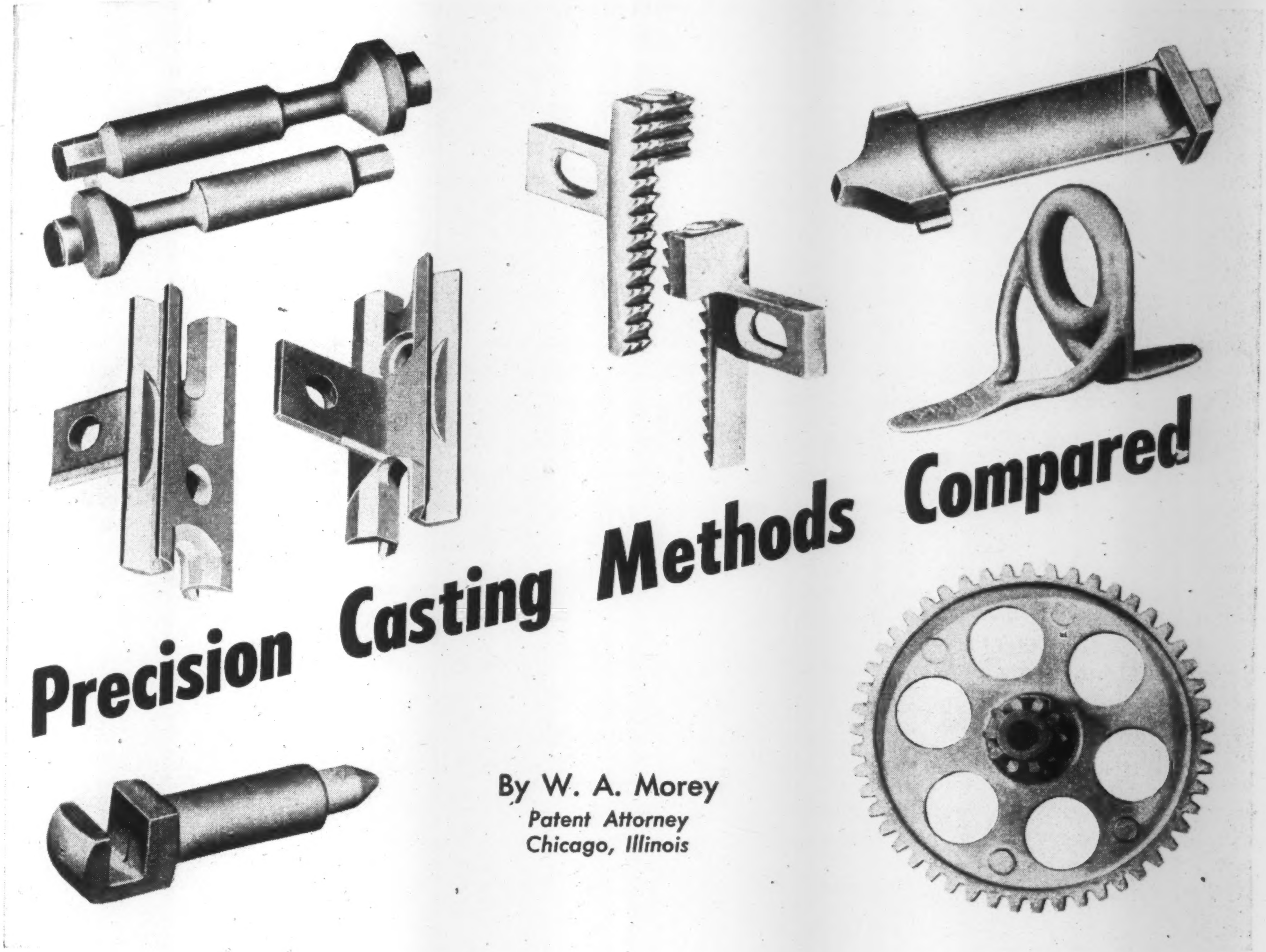
Co-operation of the following companies in supplying data and illustrations for this article is greatly appreciated:

Cook Electric Co. (*Fig.* 17)	Chicago
Durametallic Corp. (*Fig.* 7, 8, 9, 10)	Kalamazoo, Mich.
Fulton-Sylphon Co. (*Fig.* 16)	Knoxville, Tenn.
The Johnson Corp. (*Fig.* 13)	Three Rivers, Mich.
Schwitzer-Cummins Co. (*Fig.* 15)	Indianapolis
Sealol Corp. (*Fig.* 14)	Providence, R. I.
Syntron Co. (*Fig.* 11, 12)	Homer City, Pa.

Interchangeability Simplifies Production

Interesting approach has been made in design of a series of steel-frame motors by the Westinghouse Electric Corp. While the motors incorporate several improvements in design, their outstanding feature is interchangeability of parts. The basic unit consists of a rotor-stator pair. From this basic unit may be assembled a splashproof, an open-protected, or a totally-enclosed motor. Basis of the development is the technique of machining ends of frame and lamination stacks in one setup. Accessory parts are thus interchangeable and rotor eccentricity and air-gap are held within the necessary tolerances. Seen in the illustration above are the major units and their component parts. To the rotor-stator pair are added brackets *C* to make open protected motor, center. Splashproof motor, left, is made by adding to the previous combination hoods *D*. Totally-enclosed fan-cooled motor, right, is made by adding brackets *F*, spacers, *E*-1 and *E*-2, blower G, and hoods H. Brackets seal inside and support bearings.





Precision Casting Methods Compared

By W. A. Morey
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Fig. 1—Above—Machining of many parts is uneconomical and in some cases impossible due to design complexity or extreme hardness of material employed. Such parts often can be produced easily by the investment casting process, as above. Photographs, courtesy Haynes Stellite Co.

PRECISION casting is a somewhat abused term often employed to describe parts made by the lost wax investment casting process, *Fig.* 1. To at least some extent the inclusion of the word *precision* in such a definition is improper, since, like many other processes, lost wax investment casting will yield precision results only in proportion to the care exercised in the execution of the work. Properly, precision casting should mean just exactly what the term implies and should not be employed to designate any specific process. The term investment casting is most suitable for use in defining the lost wax process since it is characterized primarily by the use of a molding material which completely enrobes or invests an expendable pattern. If for no other reason but to serve as a basis of comparison, it seems desirable to review briefly the investment casting process.

Generally speaking, there are two types of investment casting distinguished by the presence or absence of a primary investment. The term primary investment designates a coating applied to an expendable pattern before the main body of molding material is poured around the pattern. The pattern employed must be expendable in some manner, usually through the application of heat to cause vaporization or melting. Wax customarily is employed as pattern material, but various plastic materials, such as polystyrene, are becoming increasingly popular. Low-melting-point alloys also have been used to some extent.

Patterns are formed by pouring or injecting the selected material into a die

AMONG DESIGNERS, the term "precision casting" has a variety of meanings. Properly, each of the many methods of production casting available has its relative level of precision. In this article, based on a paper presented before the recent foundry conference held at Lansing, Mich., by the AFA, the author discusses the advantages, limitations and precision level of each method, and compares costs and production characteristics made of steel or a relatively soft metal. After removal from the die, flash is trimmed and the expendable pattern mounted on a button. Careful attention is given to the position of the sprues to eliminate porosity, turbulence and shrinkage in casting.

If a primary investment is to be employed, it is applied to the pattern at this point by dipping or spraying. Primary investments generally include a refractory material, such as cristobalite sand, with a binder and other modifying ingredients. Great care is taken to eliminate all air bubbles from the surface and insure close adherence of the investment material to the pattern. In most instances a relatively coarse sand is sprinkled over the primary investment after application to insure proper bonding between the primary and secondary investments. This is necessary since the sands employed in the primary investment usually are well under 40 micron size.

After the primary investment has dried, the pattern is mounted on some type of base, such as steel or rubber. Wax can be used to anchor the pattern to the steel plate. A can made of heat resisting material, such as stainless steel, is placed over the pattern and secured to the base to contain the secondary investment. If a primary investment has been employed, the secondary investment can contain relatively coarse aggregates to provide good porosity and resistance to cracking. However, if no primary investment has been employed, the secondary investment must be composed of very fine aggregates and great care taken to eliminate substantially all air from the mix.

Variety of Investments

Exact compositions of the various mixtures employed for primary and secondary investments vary widely. While the refractory employed ordinarily is sand, the binder may consist primarily of a silicate, phosphate or aluminate in one of many forms. One of the most popular is ortho-ethyl-silicate.

When a sufficient quantity of investment material has been placed around the pattern, the mold is allowed to dry. Time of drying and the temperature are dependent upon the type of binder and pattern material. Care must be taken in drying to hold the temperatures below the softening point of the pattern material. In the case of wax, a drying temperature of approximately 120 F can be employed. This temperature can be increased to some extent by employing plastics having higher softening points.

After drying, the inverted mold is placed over a heat source and the wax pattern allowed to drain from the cavity. The molds are then placed in a furnace and slowly raised to casting temperature, which is variable, being dependent upon the type of alloy to be cast. For ferrous metals temperatures from 1400 to 1900 F customarily are employed. This heat not only expands the mold an amount approximately sufficient to overcome the shrinkage of the metal during solidification, but also vaporizes

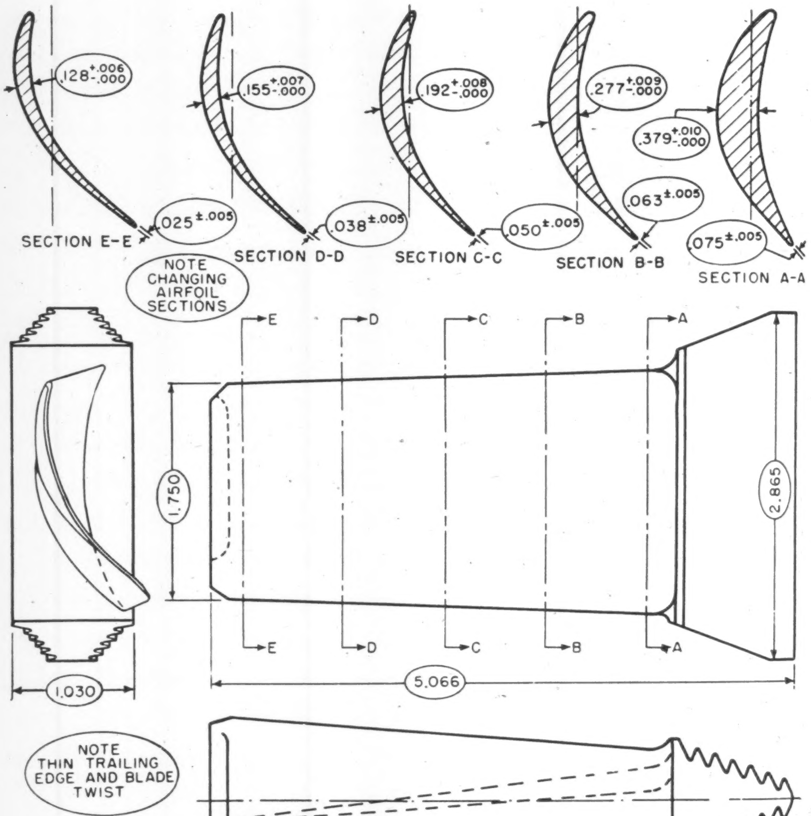


Fig. 2—Above—Although some small parts have been produced successfully to ±0.0005-inch, where wax patterns are used, practical tolerances should be no smaller than ±0.003, preferably ±0.005. Drawing, gas turbine impeller blade, courtesy Haynes Stellite Co.

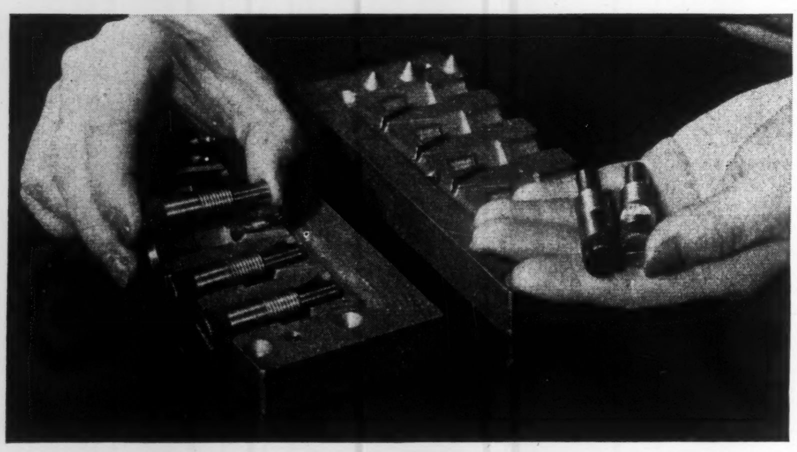


Fig. 3—Left—Coring usually is simple with investment castings. As a rule, a class 2 thread tolerance can be held. Photo, courtesy Haynes Stellite Co.

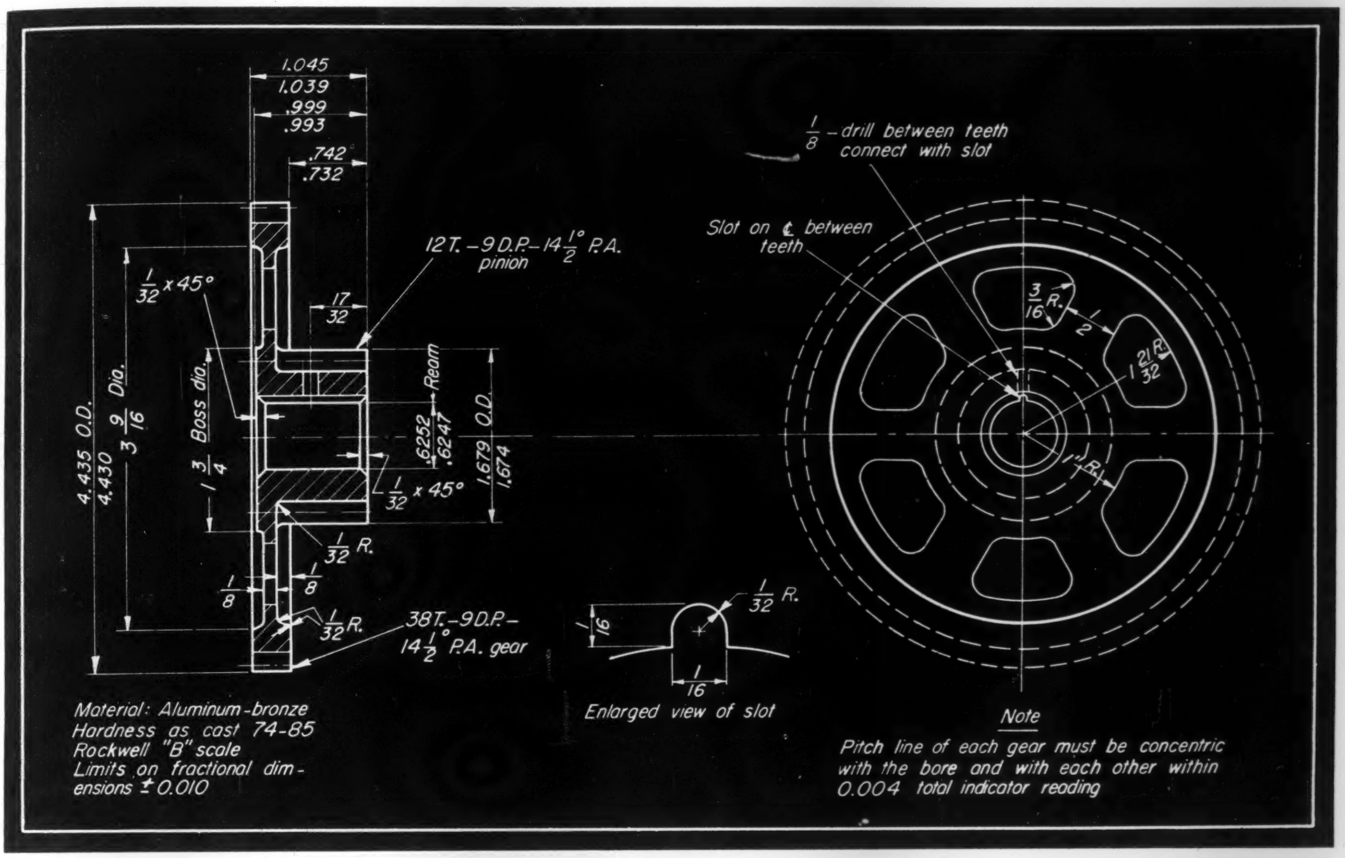

1.045
1.039
.999
.993
.742
.732
12T.–9 D.P.–14 1/2° P.A. pinion
1/32 x 45°
17/32
4.435 O.D.
4.430
3 9/16 Dia.
1 3/4 Boss dia.
Ream
.6252
.6247
1.679 O.D.
1.674
1/32 x 45°
1/32 R.
1/8
1/8
1/32 R.
38T.–9D.P.–14 1/2° P.A. gear
Material: Aluminum-bronze
Hardness as cast 74-85
Rockwell "B" scale
Limits on fractional dimensions ± 0.010
1/8 – drill between teeth connect with slot
Slot on ℄ between teeth
3/16 R.
1/2
1 21/32 R.
1 1/4 R.
1/32 R.
1/16
1/16
Enlarged view of slot
Note
Pitch line of each gear must be concentric with the bore and with each other within 0.004 total indicator reading

Fig. 4—Permanent-mold cast cluster gear for a stoker transmission. Teeth are finished by a light shaving cut and side faces and bore are machined. Photograph, courtesy McGill Mfg. Co.

the last traces of expendable pattern material remaining.

It should be noted that if plastic is employed, the entire pattern elimination occurs in the furnace and primarily is a process of combustion rather than melting. The molds normally are cast quite hot with pressure of some type utilized to force metal into the mold. Ordinary processes include centrifugal casting about an external axis, application of air pressure to the molten metal, or the application of vacuum to the mold.

Under proper conditions and with proper technique, investment casting is truly precision casting since it is quite feasible to maintain overall tolerances of 0.003-inch in production, *Fig.* 2. If necessary, these tolerances can be reduced substantially by the application of extraordinary care and an increase in the number of rejects.

As with most relatively new processes, there is a great tendency to attempt application to fields and items beyond its current scope. Investment casting has a very definite field of its own which is not truly competitive with other casting procedures. This field may be defined best by comparing the various advantages and disadvantages of each of the so-called precision casting methods.

Alloys Used: Investment casting offers a practically unlimited range of metals and alloys, perhaps even greater than sand casting, together with outstanding control of shape, surface and tolerances. Accuracy, as cast, in many instances permits the use of investment-cast parts directly in a machine without secondary operations except for cutting off the sprue and perhaps buffing.

Porosity in properly made investment castings will be either very low or completely absent, and the physical properties of the various alloys are excellent. Ferrous castings have been made with properties equal to those of forgings in all respects except impact strength, and some properties better than with parts machined from forgings.

Complex coring, *Fig.* 3, is not difficult in the investment process except in instances where long, thin, unsupported cores are required. This type of core frequently causes difficulty in the process.

On the debit side of the ledger, however, it must be noted that the cost per pound of casting is extremely high and that the process is limited to the production of relatively small sizes. In many instances, it is not desirable to attempt the production of castings of over ½-pound net weight, although castings of larger size have been made successfully. As is the case with many other casting processes, difficulty is experienced in maintaining relatively large flat surfaces.

Complex Shapes Easily Produced

Labor costs per mold in the investment process, as well as initial die costs, are relatively high. Therefore, the process is most applicable to the casting of small shapes which are highly complex or are to be formed of a hard material. In this connection it should be noted that the reproduction of complex curves, *Fig.* 2, by this process is not particularly difficult and that in such instances the reproducibility customarily will exceed that obtainable by production machining.

Plaster Mold Casting: This method offers attractive characteristics in the nonferrous field and most particularly with the various copper-base alloys. In this process a plaster composition is cast against carefully machined metal match plates to form cope and drag sections. After setting, the mold is removed and all free and combined water driven from the material. Cores are formed by the same process and assembled after drying with the dried cope and drag. The mold then is poured by gravity.

Castings made by the plaster mold process have excellent surface detail and conform closely to shape. Porosity is low and the castings exhibit satisfactory physical characteristics well adapted to conventional heat treating practice. One of the outstanding characteristics of this process is the ability to handle castings requiring complex cores. With the possible exception of the investment casting process, few casting processes can compete successfully with plaster mold castings in this regard.

Initial die or pattern cost is reasonably low and a good range of nonferrous alloys is available to obtain the desired physical properties. While aluminum, magnesium and various other alloys can be cast satisfactorily by this process, it is most outstanding for results obtained on copper-base alloys. Castings up to about 18-inch diameter and 5 or 6 inches thick have been cast successfully.

Labor cost per mold in the plaster mold process is relatively high, which indicates that the process is not particularly well adapted for large-scale production. Tolerance control, while satisfactory in many instances, will not approach that available either by investment casting or die casting. Metals having melting points over 1900 F cannot be cast satisfactorily in plaster molds and this, of course, eliminates steel from consideration. The use of this process appears to be indicated for complex, small or medium-size nonferrous castings in moderate number, particularly if the coring required is complex.

Die Casting: Advantages and disadvantages of die casting are relatively well known. Briefly, die casting provides means for obtaining excellent surface and tolerance control at low cost if the volume is sufficiently large. Thin sections can be produced and within the range of alloys applicable to the process, good physicals are available.

The process is not particularly applicable to instances where only a moderate number of castings are required or where physical properties, such as resistance to impact, are of primary importance. Initial die cost is relatively high, size is somewhat limited, and in some instances porosity is quite troublesome, although this often can be eliminated by proper design and processing. The most fundamental weakness of the process apears to be the relatively limited range of alloys available.

Permanent Mold Casting: This casting process employs a coated metal mold poured by gravity. Best characteristics are obtained with nonferrous alloys and up to medium-sized castings can be produced with moderately complex cores at a reasonably low cost. Speed of production and labor requirements per mold are intermediate between die casting and the plaster mold process.

Surface finish of the castings, in many instances, is not sufficiently smooth to use as a working surface without secondary machining operations. Some difficulty is experienced with porosity, and control of shape in most cases, is only fair. In this regard, however, recent advances in technique seem to indicate that much better shape and tolerance control can be expected in the near future, *Fig.* 4. The process seems primarily adapted to the production of nonferrous castings where relatively large production is required and only moderate tolerances necessary.

Cores Impractical in Centrifugal Casting

Centrifugal Casting: This covers so many potential processes that it is dangerous to attempt to express general advantages and disadvantages. Characteristics of the process vary considerably, depending on the type of mold employed and location of the axis of rotation.

Generally speaking, centrifugal castings exhibit low porosity and a reasonably good external shape control if the casting is revolved about an internal axis. Obviously, some internal machining will be required, although this does not necessarily follow if the piece is swung about an external axis. Both ferrous and nonferrous castings can be produced, neither labor nor mold cost is excessively high, and a reasonable speed of production can be obtained. As a rule, with an internal-axis centrifugal process, it is difficult to cast pieces requiring cores and often the final surface finish leaves something to be desired.

It seems superfluous to attempt the inclusion of sand casting in this discussion since it is well known. Familiarity should not breed contempt since various foundries have been producing sand castings which border closely on the precision casting field, *Fig.* 5.

Development work in the future probably will point in the direction of substantially greater precision and better surfaces at lower costs. Whether this will be in the nature of refinements or improvements to reduce the cost of the precision techniques, or in increased accuracy in the casting fields currently offering only relatively low tolerance and surface control, remains to be seen.

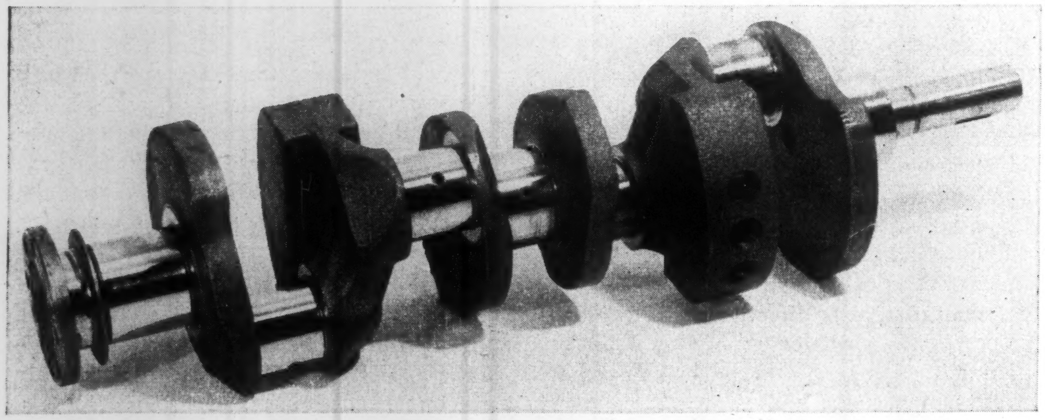


Fig. 5—Left—Crankshaft for a V-8 engine sand cast of a special analysis steel eliminates forging and provides improved fatigue life. Photograph, courtesy Ford Motor Co.

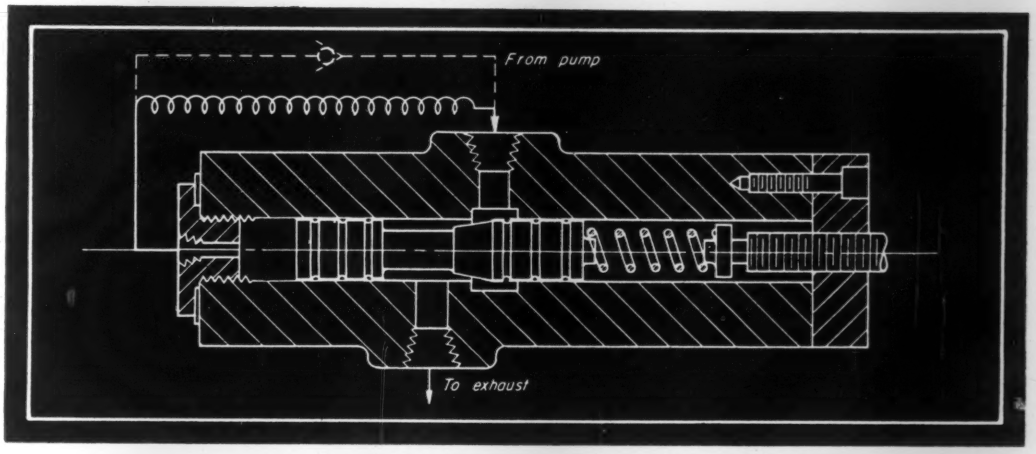
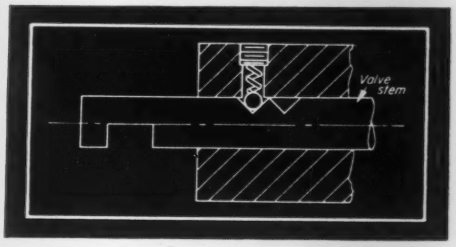


Fig. 30—Right—Specially designed pressure regulating valve with a choke coil to prevent valve chatter or other undesired oscillation

Fig. 31—Below—A common type of mechanical valve detent, simple in design but affording rather unsatisfactory reversal accuracy



Machine Hydraulics

By Albert H. Dall
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Part IV—Special Valves

PRECEDING articles in this series dealt with the feed rate control of hydraulic systems wherein special valves were used at certain points to obtain the desired performance. In the systems which provided control of both forward and back pressure, the differential relief was used and balanced circuits were developed around the special balancing valve.

Special valves are designated as those valves which perform *special* function either in the distribution of the fluid or in the modification of feed rate in cyclic operations. Specially designed valves which perform *standard* functions do not fall under the definition of special valves. For instance, in *Fig.* 30 is shown a pressure regulating valve with a special feature designed to prevent valve chatter. The choke coil used prevents rapid displacement of the fluid from the end of the valve and thus the valve will not oscillate. If a quick-opening valve is desired, one-way damping can be obtained by using a check valve as shown in phantom.

In like manner, specially designed reducing valves, check valves, etc., will not be regarded as special valves. Only those few special valves whose functions are unusual will be discussed.

Detent Valve: In various hydraulic circuits, pilot valves and other valves must be held in position by detents, and for many years mechanical detents were used exclusively for this purpose. A simple type of me-

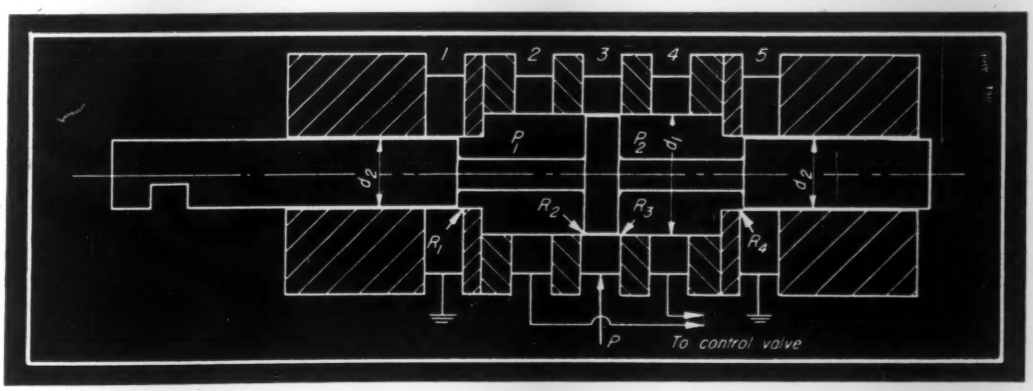


Fig. 32 — Right — Pilot valve with hydraulic detenting action can have a repeat firing point accuracy of 0.0001-inch

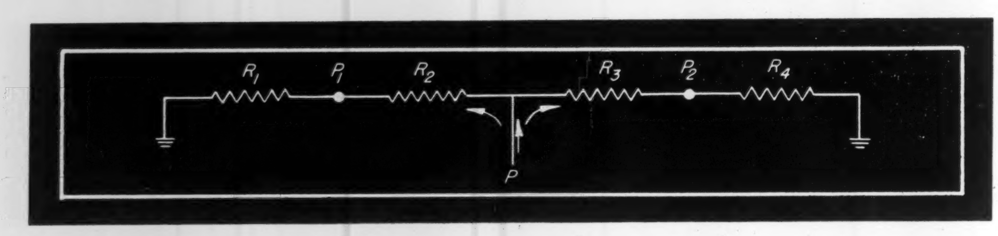


Fig. 33—Left—System of resistances, with the valve plunger of Fig. 32 centered, illustrates pressure-differential firing action

chanical valve detent is shown in *Fig.* 31. When a detent such as this is used on a pilot valve for reversing, the accuracy of reversal is not too satisfactory. More elaborate mechanical detents can be designed for accuracy but only with a consequent increase in cost and an undesirable increase in size.

A compact design in which the function of the detent is incorporated hydraulically is shown in *Fig.* 32. This valve has all the elements of a reversing valve where ports 2 and 4 are alternately pressure and exhaust. Leads from these ports are connected to the ends of the main reversing valve. As illustrated, the valve is in its mid-position, a condition which is virtually imposible to realize when the valve is in operation. In this mid-position the valve is slightly underlapped. The circuit in *Fig.* 33 shows, schematically, a possible set of resistance values at the mid-position with $R_1=R_2=R_3=R_4$. On inspection, it is obvious that $P_1=P_2=P/2$. The slightest movement to the right will increase R_3 and R_1 and decrease R_2 and R_4, thus causing P_1 to exceed P_2. This difference in pressure P_1-P_2 will act on areas $\pi(d_1^2-d_2^2)/4$, causing the valve to move further to the right and thus increasing the pressure difference. The valve will therefore fire to the right or left as it passes mid-point in a manner similar to a mechanical detent but with far greater accuracy and consistency.

It must be pointed out that although the explanation above is based on $R_1=R_2=R_3=R_4$ at the mid-point, such accuracy of manufacture is not required. The hydraulic mid-point would be the condition where $P_1=P_2$ and innumerable ratios of resistance will afford this since P_1 and P_2 vary in a complementary fashion and must therefore pass through the condition where they are mutually equal.

Valves of this type have been made which have an accuracy of firing point of approximately 0.0001-inch. Stopping of the valve in its extreme positions should be done externally since it is obvious that the mid-shoulder should not pass over the ports 2 and 4. This can be done by limiting the motion of the handle which operates the valve.

SELF-CENTERING VALVE: If the valve in *Fig.* 32 is connected to pressure and exhaust differently, it can be made into a self-centering valve. This can be done by applying pressure to ports 4 and 5 and connecting 3 to exhaust. The valve will always seek center and thus will perform in opposite fashion to that in which it operates as a detent valve.

The self-centering valve can be used as a hand-operated reversing valve which will always seek neutral. As the valve is displaced from center, the resistance to movement will gradually increase and an operator will thus get a certain degree of "feel".

Detent Valve Used to Avoid Shock

ACCELERATION VALVE: When a heavy machine table is reversed abruptly, the shock of reversal is often detrimental to the accuracy of the work produced. Means must be provided to minimize acceleration and eliminate the shock of reversal when a quick-acting reversing valve system is used. In *Fig.* 34 is shown a system of special valves for limiting the deceleration and acceleration of a machine table. The detent type of pilot valve is used with extended portion for this special function.

This system is shown in plan with the table dogs moving vertically. The handle and valve system is permanently mounted in the bed and as the table moves down-

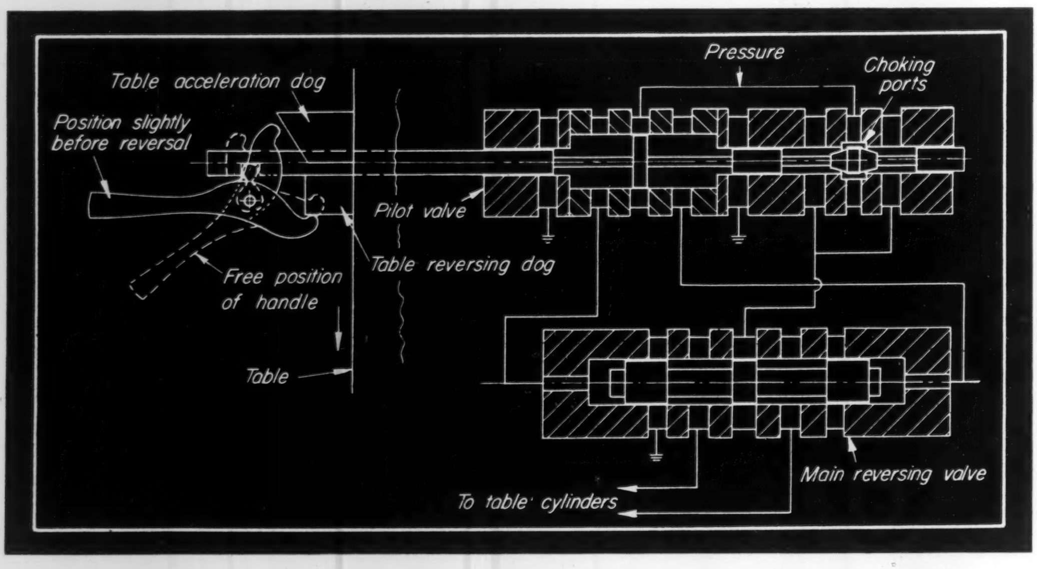


Fig. 34—Left—Valve system for limiting acceleration of a machine table. Special hydraulic detent pilot is utilized

ward, the wedge-shaped reversing dog engages the handle lug. This causes the handle to rotate clockwise, moving the pilot valve to the right. As the pilot valve approaches its center position, the pressure lead to the reversing valve is throttled by the choking ports and the rate is gradually diminished until the pilot valve fires, causing a reversal of pressures on the ends of the main reversing valve. When the pilot valve is fired, however, its motion is limited by the acceleration dog on the table and thus the rate is slow after reversal because of the same choking condition. As the table and dogs move upward, the lug on the handle engaging the acceleration dog gradually moves downward, opening the choking ports wider because the detenting pilot valve is continuously urging the lever clockwise. On the opposite end of the stroke, the events are similar but in opposite sequence.

Hydraulic Latch Valve: Illustrated in *Fig.* 35 is an application of the detenting principle for use on a valve which latches itself. In this application one-half the valve of *Fig.* 32 is used with a return spring. In some automatic machines which are cam operated the latching type valve has been found useful.

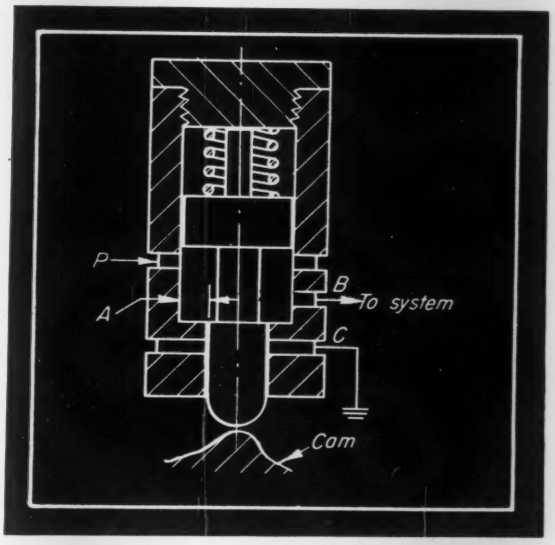
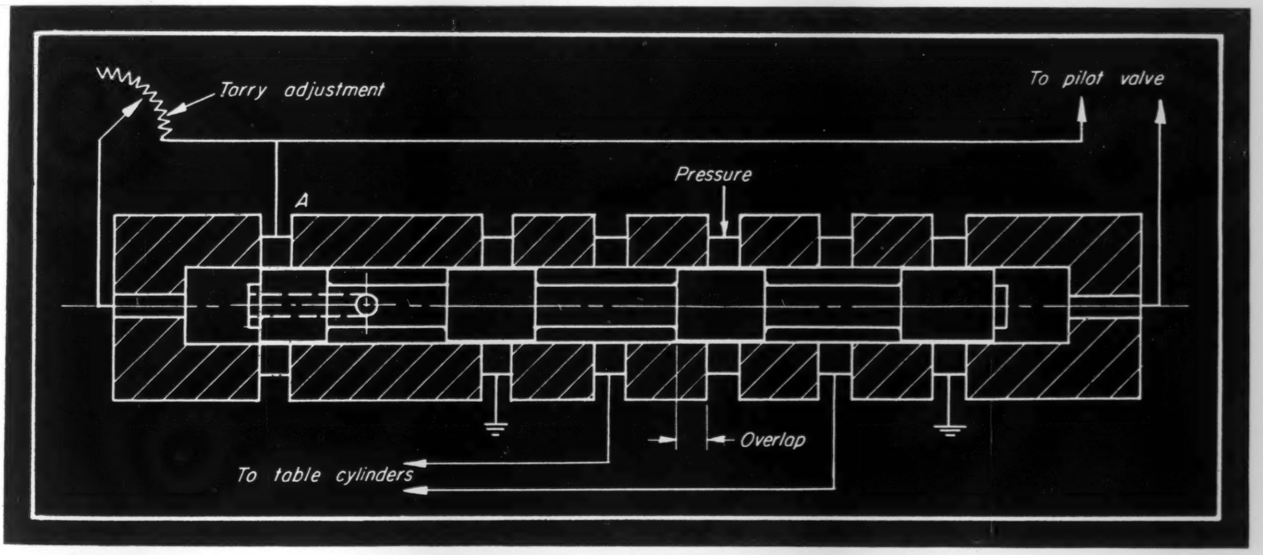


Fig. 35—Above—Self-holding latch valve, for automatic cam-operated machines, utilizes the hydraulic detenting principle

Fig. 36—Below—Modification of main reversing valve designed to perform acceleration-limiting or tarry function

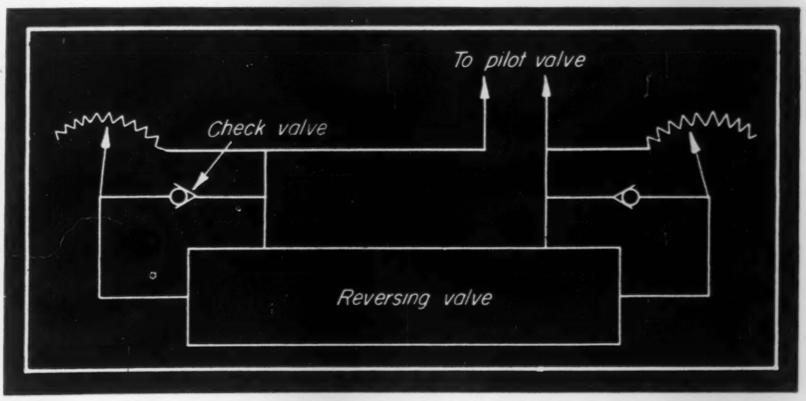


When the valve is cammed to a position where the pressure port opens and the exhaust port closes sufficiently to build up a pressure against the valve shoulder high enough to overcome the spring, the valve will fire. The valve will stay in its upper position until the pressure is cut off, at which time the spring will cause it to move back to its original position. Several of these valves acting on the same cam makes it possible to obtain a wide variety of cyclic hydraulic controls.

Tarry Reversing Valve: Detailed previously, in *Fig.* 34, was a reversing valve system incorporating an acceleration limiting device. The function of tarry at the reversal can also be accomplished by a modification of the main reversing valve as shown in *Fig.* 36. This valve is made with considerable overlap to accomplish the function of tarry or dwell at reversal.

Tarry could be accomplished by simply overlapping the reversing valve and placing a variable resistance in one of the lines from the pilot valve to the end of the reversing valve. However, the point at which the slide would stop after the pilot valve fires

Fig. 37—Below—Reversing valve incorporating a system of throttle and check valves to obtain independent tarry at each end of stroke



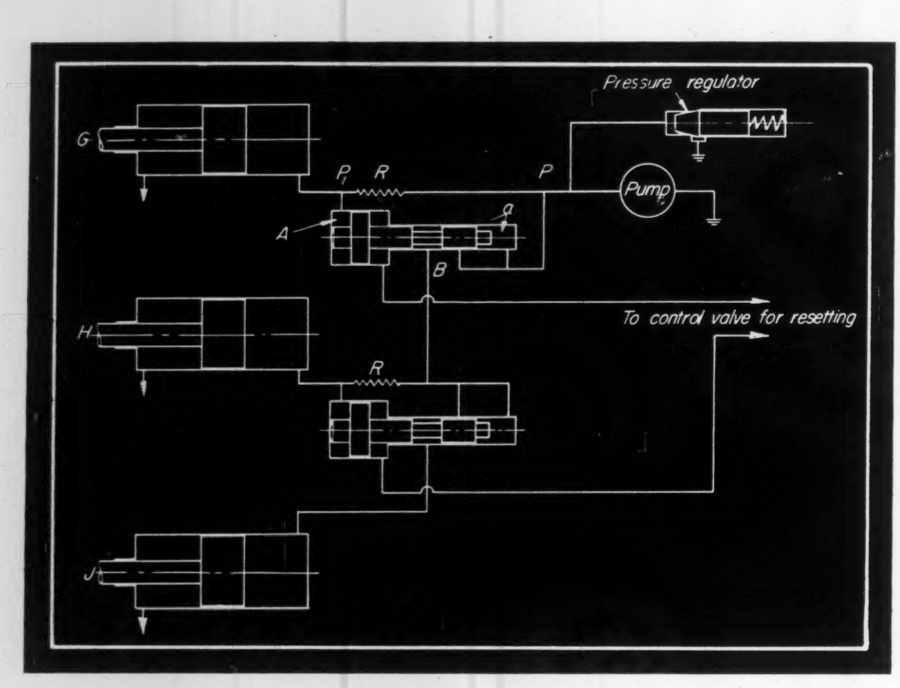


Fig. 38—Left—Valving system for sequential movement of machine slides employs stoppage of flow for control

would vary greatly, depending on the tarry setting. In order to overcome this weakness, port A is used to short-circuit the variable resistance for the first part of the movement. In *Fig.* 36, for instance, the valve has just fired to the left and closed off port A, and fluid from the left end of the valve must pass through the resistance in order to permit the valve to complete its movement. When port A is uncovered again, the balance of the movement will be rapid. The same sequence of events occur when the valve is shifted to the right.

If it is desired to have a different tarry time on one end of the stroke than on the other, a system of check valves with two throttle valves can be used as shown in *Fig.* 37. A similar porting arrangement as at A, *Fig.* 36, must be put on the right end of the valve.

SEQUENTIAL VALVE: In special machines the need for sequential movement of slides is often encountered. Shown in *Fig.* 38 is a valving system where three pistons are moved in succession to a positive stop. The valve used for this purpose is often called by the cumbersome but descriptive name of "Valve Actuated by Stoppage of Flow". Assuming that piston G is moving to the left the fluid must pass through the resistance R, causing a pressure drop $P-P_1$. If $P_1A<Pa$, the valve will remain in the position shown. As soon as the piston G reaches the end of its stroke, flow through R stops and $P_1=P$. Therefore, P_1A will become PA which exceeds Pa, causing the valve to move to the right. This will establish the pump connection to cylinder H, where the same process is repeated to connect cylinder J. The pistons can be returned and the valves reset for the next cycle by means of a suitable control valve.

The same sequence valve can be used as an unloading valve for the last cylinder. If, for instance, the line B were connected to exhaust, the pump would be short-circuited when the piston G reached the positive stop. A suitable time delay in unloading can be obtained by inserting a resistance in the line between P_1 and A.

PRESSURE-LIMITING VALVE: The pressure regulating valve shown in *Fig.* 30 is often referred to as a relief valve. Although this type of valve safeguards the pump from excessive pressures by permitting fluid to by-pass at virtually constant pressure, it does not afford the desired characteristics for safety in certain machine applications. For instance, in broaching machines the pressure at the pump will rise as the tools become dull until it reaches the relief-valve pressure. From that point on, the machine may continue to operate at a reduced speed. This type of operation endangers the expensive broaching tools.

In order to make it impossible to operate at pressures above a predetermined level, the valve in *Fig.* 39 is used. It is set initially by pushing in the knob until the latch engages. This, however, cannot be done while the pump is operating because the effort required would be excessive. When the pressure P increases to a point where PA exceeds the spring pressure of S, the latch will lift and the pump will short-circuit. Thus, the machine cannot be operated until the cause of the excessive pressure has been eliminated.

The foregoing examples of special valves indicate that many ingenious but simple valves can be used to replace complex mechanical devices. Use of pressure balances and area unbalances together with resistances, offers many possibilities in valve design for special functions.

In PART V of this series, to appear in a subsequent issue, the author will deal with sensitive hydraulic servo and tracer control systems.

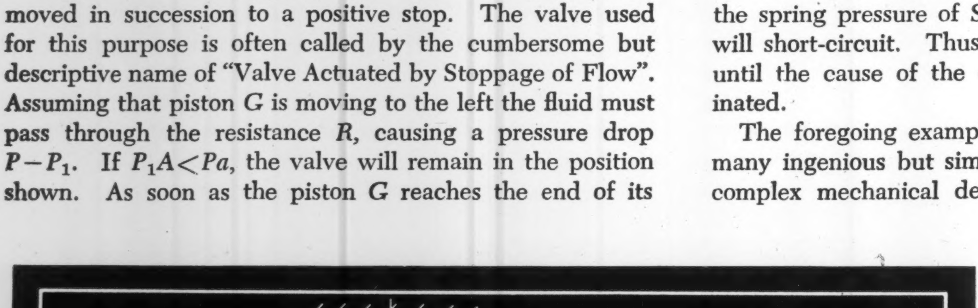


Fig. 39—Left—Positive pressure-limiting valve, for safeguarding machine members, short-circuits pump at preset pressure

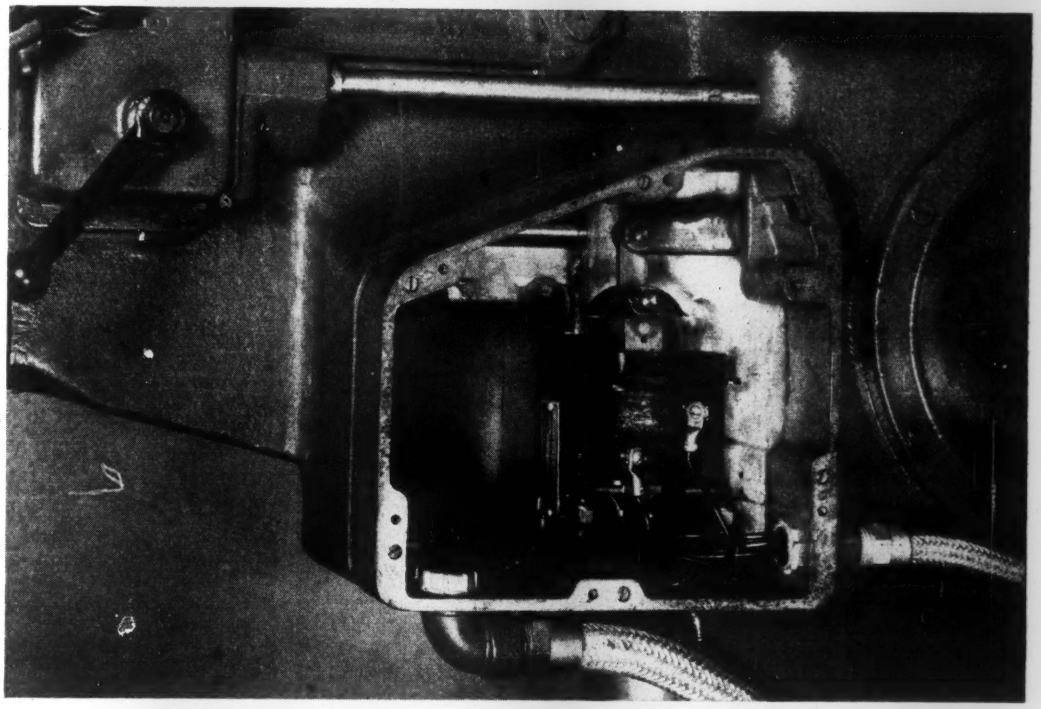


Fig. 1—Typical solenoid linkage with connecting pins held by cotter pins

Rubber-Ring Fastener

. . . proves ideal for link pins subject to high shock loads

By H. S. Sizer

Brown & Sharpe Mfg. Co.

Providence, R. I.

SMALL, simple, incidental elements of a mechanism, usually laid in as a matter of routine after the designer has worked out the major members of his machine, sometimes turn out to be serious troublemakers in service. Such has been found to be the case with fasteners used in solenoid linkages, *Fig.* 1.

Standard solenoids are designed for pin connections to links or arms. The heavy force on the connecting pins is a shearing force. There is almost no axial force on them and it would be assumed that almost any fastener would keep the connecting pin from walking out of position. Service experiences of many companies show that this is not so, for cotter pins and the common types of fastenings have short lives on solenoid linkages.

Solenoid plungers seat themselves with a blow. They must be permitted to seat, metal to metal, to obtain a good magnetic circuit and

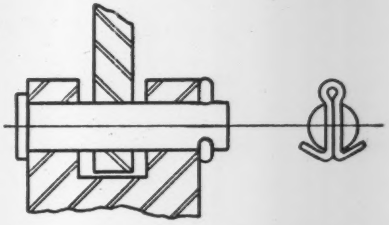


Fig. 2—Cotter pin failed in 9000 operations of solenoid

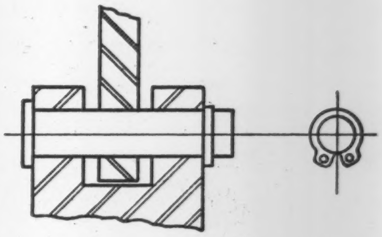


Fig. 3—Above—Snap ring failed in 9500 operations

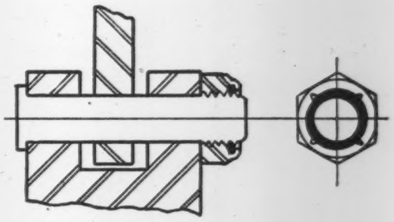


Fig. 4—Above—Nut broke connecting pin in 25,000 operations

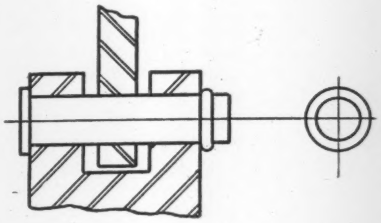


Fig. 5—Left—Rubber O-ring remained normal after 500,000 operations of solenoid linkage

low heating. To have a margin of safety in design, and to be certain a solenoid will act with decision, the pull-in force is selected to be greater than the imposed load. In addition, the pull-in force increases rapidly just before the plunger seats itself. These characteristics and limitations usually produce a high impact force as the solenoid plunger comes to rest with a blow.

Any member whose motion stops with the solenoid plunger is subjected to this impact. Cotter pins, for instance, cannot withstand such impact. In a series of tests conducted at Brown & Sharpe Mfg. Co. the average life of a cotter pin, assembled as in *Fig.* 2, was found to be about 9000 operations or plunger strokes. After this the cotter pin head sheared off or the arms broke and the pin fell out. Chamfering the edges of the cotter pin hole delayed failure but did not prevent it.

A spring-steel snap ring, *Fig.* 3, acting in a groove on the connecting pin, was also tested as a fastening. It failed in about 9500 operations. The small ears on the ring could not stand the stresses set up by the inertia of their own weight which resulted in their being snapped off.

Then a threaded connecting pin and nut assembly was tested, *Fig.* 4. The nut had a fiber insert to prevent loosening under vibration. It resisted vibration but, since a standard nut has considerable mass, its inertia forces soon caused fatigue failure of the connecting pin at its last point of support—at the edge of the solenoid plunger. Failure was in bending and occurred after about 25,000 operations.

This test suggested use of lighter nuts. A thin steel nut was tried and life jumped to 200,000 operations. With a thin aluminum nut, 400,000 operations were obtained but the connecting pin still broke.

To date, the best fastening tested is a simple synthetic rubber band or O-ring shown in *Figs.* 5, 6, and 7. Mass of the ring is light and rubber can readily absorb its own kinetic energy without being permanently deformed. Rings have withstood 500,000 cycles of operation and remained in excellent condition at the end of the test.

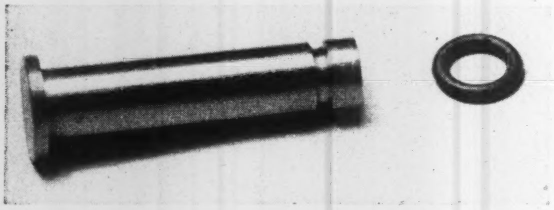
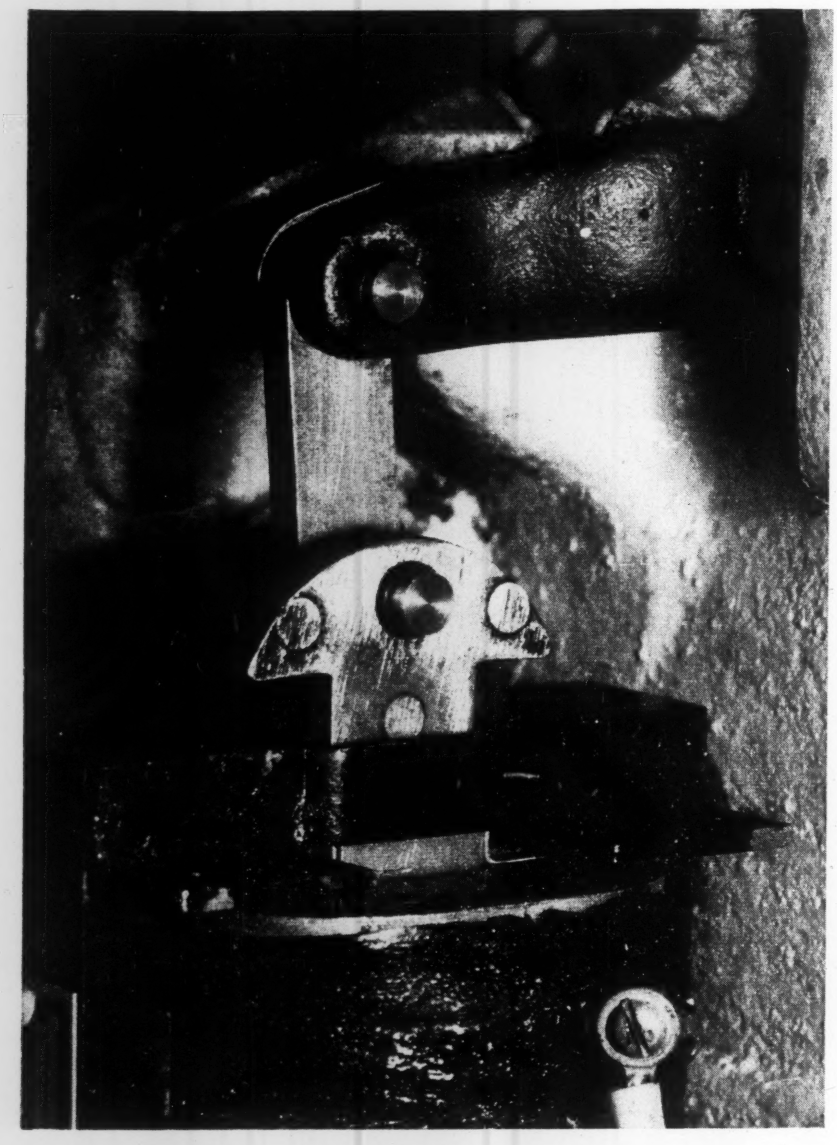


Fig. 6—Above—Connecting pin and O-ring for assemblies shown in Figs. 5 and 7

Fig. 7—Below—Solenoid linkage assembled with O-rings. Fastener outlasts normal linkage life



Rings Are Convenient To Use

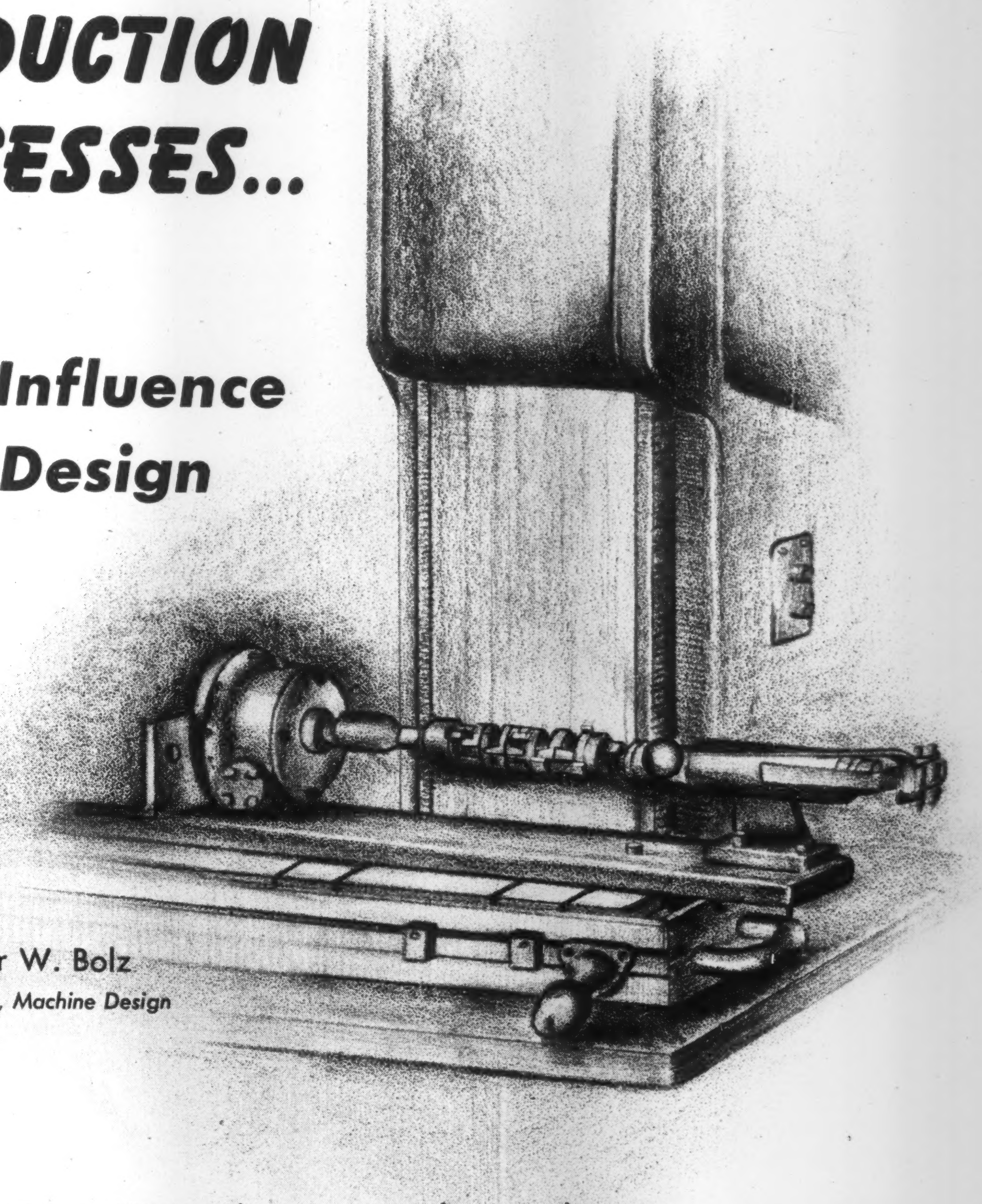
Rings should be made of oil-resistant rubber and should show little deterioration with age. The O-rings made to the Army-Navy Drawing AN-6227 from materials specified in AN-HH-P-114 b are convient to use although they are held to closer dimensional tolerances and meet more exacting physical requirements than are needed for solenoid applications.

Connecting pins designed specifically for O-ring fasteners are made with an annular groove having a semicircular cross section. When in the groove the O-ring is under little or no stress and stands out from the pin by half its cross sectional diameter. Once seated in its groove, it resists considerable axial force before being dislodged.

O-rings, used extensively as piston rings and seals in aircraft hydraulic systems, are readily available from rubber and packings manufacturers. Sizes start with a one-eighth inch hole and increase in small increments, giving most of the common fractional values. O-rings are readily assembled in position and may contribute to added simplicity in other linkage designs.

PRODUCTION PROCESSES...

Their Influence On Design



By Roger W. Bolz

Associate Editor, Machine Design

Part XVI—Abrasive Belt Machining

ABRASIVE belt surfacing is a decidedly old processing method, developed originally in the woodworking industry where power sanding was widely utilized. Use of these dry belts for production surfacing of metals, rubber, plastics, or glass, however, was out of the question owing to damage from generated heat. Advent of impervious, plastic-bonded cloth belts, with electrostatically-applied aluminum oxide or silicon carbide abrasive particles, ushered in the precision surface machining of these materials in mass production by means of the wet belt machine designed for precision finishing.

Advancement of the wet belt process was accelerated tremendously by the demands of World War II. Need for low-cost, fast finishing on a wide variety of machine parts, *Fig.* 1, where single high-quality flats, parallel or angularly disposed flats, round, and in some cases concave or convex surfaces were required, brought this method to the fore. Today, the wet-belt machine is finding its place alongside light milling machines, shapers, various types of surface grinders employing grinding wheels, and occasionally light lathes and circular grinders.

Primarily, wet abrasive-belt machining is a

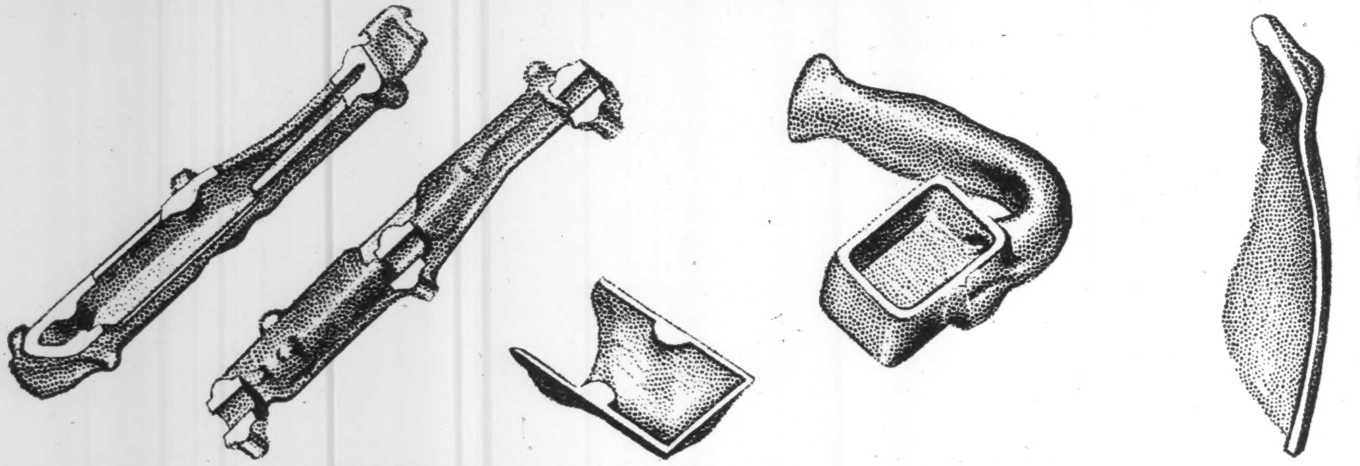
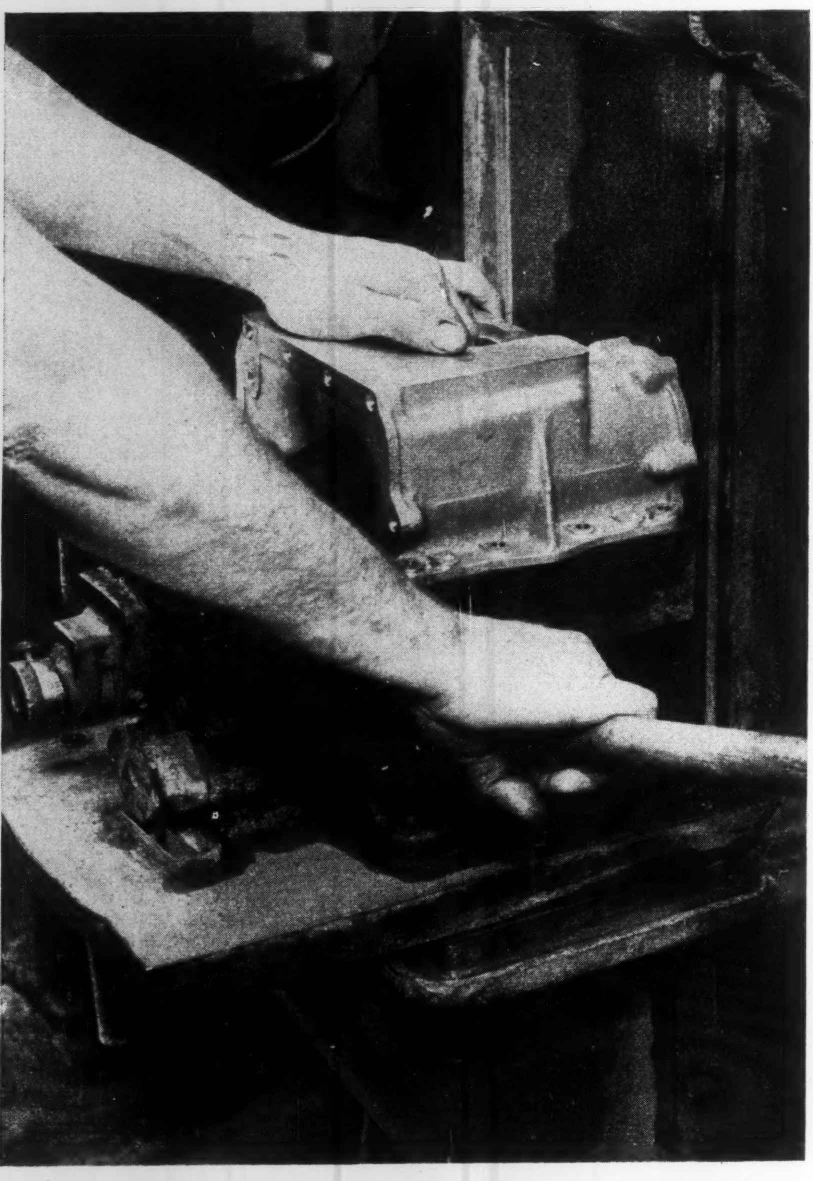


Fig. 1—Above—Abrasive belt machining provides low-cost, high-quality finishing for a wide variety of machine components

Fig. 2—Below—Horizontal feed movement of table assures a smooth flat registry surface with an excellent finish

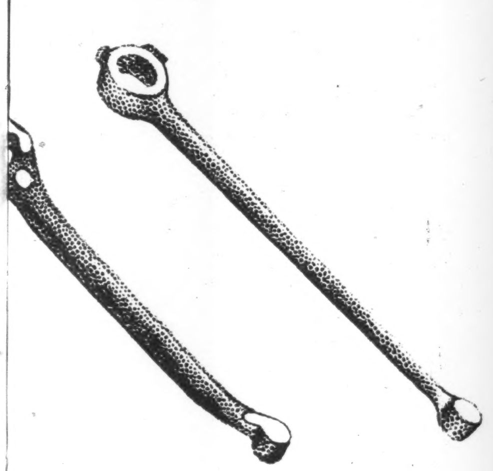


method of stock removal and surfacing performed by means of a tensioned abrasive belt operating over precision pulleys at a speed between 2500 and 6000 sfpm. Grinding or cutting takes place only where the belt passes over a sturdy support platen. Belt speeds as high as 10,000 sfpm can be attained on some machines when conditions demand it. Work is supported on a horizontal table, as a rule, and contacts the belt with a motion normal to the belt travel, *Fig.* 2. Contoured parts, however, require a different technique since they must be fed directly into the belt to maintain the contour on the shaped platen. Accuracy of the table-to-platen relationship and also the accuracy of the platen surface itself largely dictate the accuracy of the finished pieces. Millions of uniformly graded and spaced abrasive grains on the belt move rapidly across the entire surface of the work at the same speed and, continuously flushed clean with coolant, impart a uniform surface finish without creating much pressure or heat.

Surface Finish Excellent

Work hardening or warpage due to generation of heat is seldom if ever a problem. Fusing or melting of soft and low-melting-point materials such as plastics thus is obviated also. Stock removal on all materials is clean and no burrs are produced. Even though surfacing is fast, an excellent finish is obtained on most all materials and in many cases better than that in milling, planing or turning.

The unusually high rate of cut effected by this method makes possible an extremely high production speed—some operations requiring but 5 seconds. Since the cutting pressure of the belt at high speeds is low, there is no tendency to spring the work. Jigs and fixtures, therefore, can be simple and inexpensive to permit quick loading and unloading, *Fig.* 3. In fact, many operations



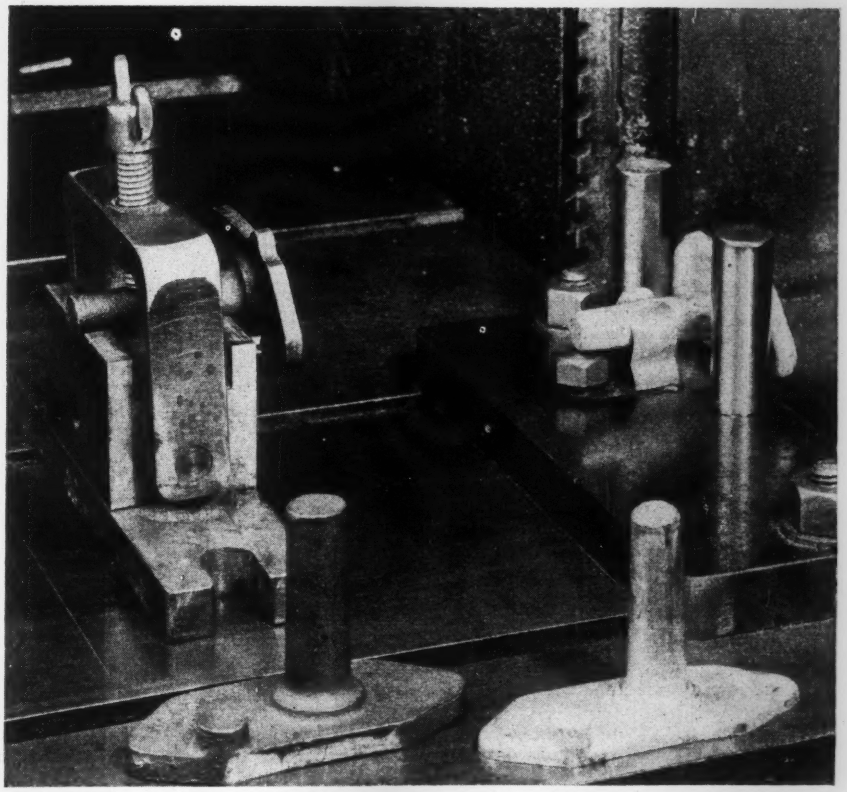


Fig. 3—Right—Simplicity of jig for belt finishing, right, compared with one for milling the same part, left. Piece at right was specifically redesigned for the wet belt

can be handled in a freehand manner to further simplify handling. However, where production runs into many thousands, multiple type fixtures are found expedient, *Fig.* 4. Such fixtures, although somewhat higher in cost than the simpler types, reduce overall cost per piece.

While parts designed for shaping, planing or milling generally require at least ⅛-inch of metal for machining, only around 0.015-inch allowance is necessary for belt finishing. This factor in conjunction with the high production speed and low cost of abrasive belts and machines can result in substantial economies through proper application.

Quite naturally, as with other processing methods, designing to make the most of these advantages is subject to a number of limitations. These limitations sum up to: (1) Amount of stock removal, (2) size range of parts which can be handled most efficiently, (3) type of surface to be finished, and (4) accuracy.

Obviously, the lighter the cut necessary, the greater the advantage in time, belt life and fixture outlay. Although 0.015-inch stock allowance for hand surfacing and about 0.031-inch for automatic power-feed machines usually is considered most efficient, as much as 0.125-inch can be handled on power feed arrangements. However, about 0.062-inch for nonferrous materials and about 0.031-inch for ferrous materials is considered a practical maximum for production jobs.

Stock Removal Limits Area

Generally speaking, nonferrous materials permit the surfacing of larger areas than do ferrous materials, although the amount of stock to be removed is a deciding factor in determining the practical area limitation. The greater the stock removal the smaller the area which can be surfaced. To start, an area of 30 square inches generally is accepted as an economical limit before the restrictions of material and stock removal factors are considered. With the lightest possible stock removal, say 0.003 to 0.005-inch, on nonferrous parts, areas up to 52 square inches have been finished succesfully. However, the usual top limit runs to about 40 to 45 square inches.

Although many parts with large, solid flat areas have been ground, it is much more difficult to surface solid areas than dispersed or interrupted ones. A solid area of glass, cast iron or steel requires great quantities of water and a special corrugated support platen to allow the coolant to reach all the worked surface to prevent firing. Consequently, it is well to avoid large solid areas

Many simple vertical and horizontal type belt surfacers are available in various sizes. However, the vertical automatic power table models are best suited for high production precision work. With these power models, production jigs and automatic fixtures make possible a wide variety of work. Using the automatic feed table and a motorized fixture, even difficult turning jobs have been handled within extremely close dimensional limits. Largest of these machines offers a working surface 10 inches wide by 17½ inches high. Use of a plain table in lieu of the automatic oscillating one increases this available working height to 24 inches. Thus, it is evident that only those parts that fall within this dimensional range and the preceding area limitations can be handled readily.

Design: From the foregoing discussion it will be seen that a wide variety of surfaces can be designed to utilize the low-cost production advantages of the wet belt surfacer. Although many concave and convex type surfaces can be machined by using special formed platens, as a rule, surfaces generated by the belt operating against a flat platen are most practical and economical, i.e., flat surfaces, flat related surfaces, cylinders, etc.

In addition to the small material allowance of about

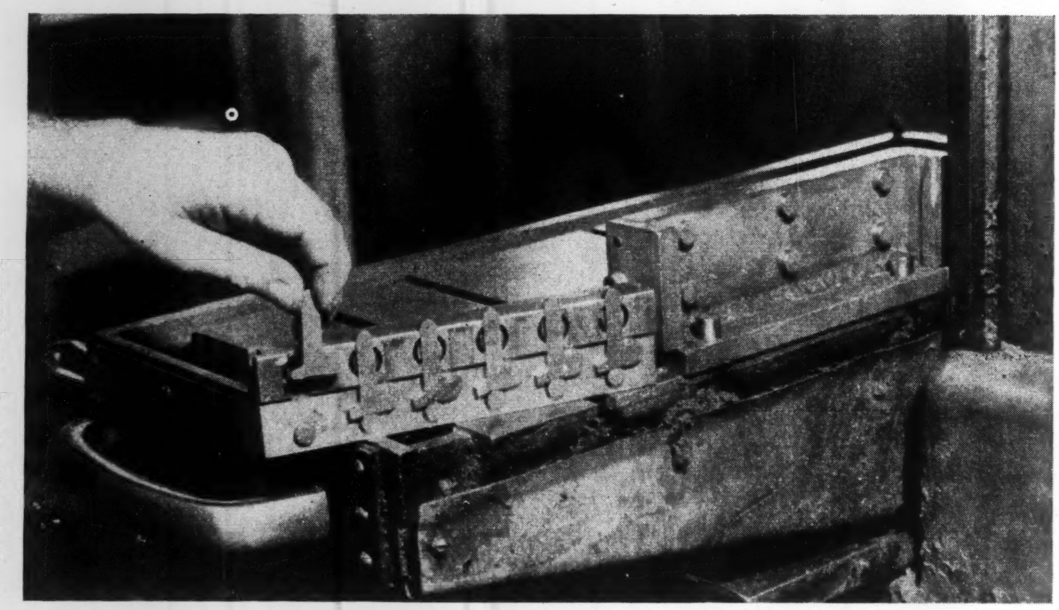
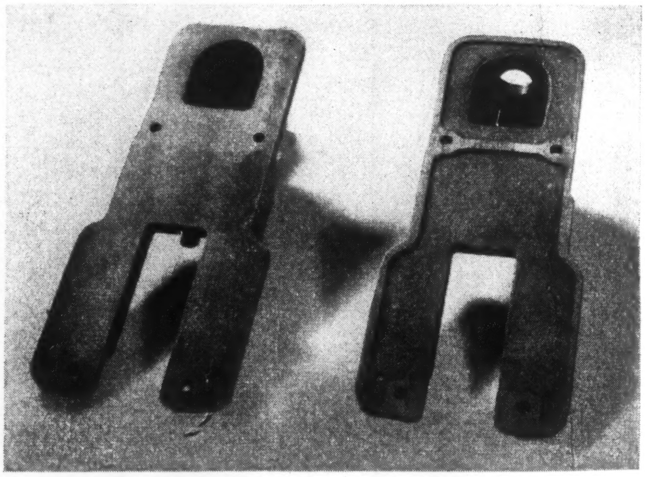


Fig. 4—Left—Mass production fixture for finishing seven stampings at once. One jig unit can be loaded while another is in the machine. Parts are ground to an overall flatness of 0.002-inch

Fig. 5 — Below — Idler pulley carrier as originally designed for milling, left, and as redesigned for belt finishing, right. In addition to a substantial reduction in material required, production time for belt finishing was 6.26 hours per hundred pieces as compared to 32.5 hours per hundred for milling



0.015 to 0.031-inch mentioned previously, still further material savings can be achieved by designing for the belt method. Whereas with milling, etc., a solid surface often is desirable for achieving a uniform cut, an interrupted surface is the ideal for belt finishing. Thus it is possible to core out large, flat areas and effect considerable savings in material, *Fig.* 5. Further, generation of accurate gasket and registry faces becomes a simple and highly economical operation.

Obviously in designing parts with mating surfaces and scattered bosses, such surfaces should be kept in a single plane wherever possible, *Fig.* 1. This procedure simplifies production whether the part is specifically intended for finishing on the belt grinder or not. Registry faces, as in *Fig.* 5, usually need be only about ¼-inch wide except at bolt holes. Gasket or sealed faces should be kept as narrow as is practicable, *Fig.* 2, to assure adequate unit pressure and yet encompass the bolt holes.

MATERIALS: Practically any of the metallic or nonmetallic materials used in the fabrication of machine parts can be finished on the wet or dry belt surfacing machine. The various steels usually are finished with aluminum oxide belts and the softer metals, plastics, hard rubber, glass, ceramics, fiber, etc., are machined with silicon carbide abrasive. Water is used largely for cooling, but in some cases, as with magnesium, special coolants have been produced for safe operation.

Often such materials as aluminum alloys are finished dry. Critical materials such as magnesium and those that are highly heat sensitive are ideal for the wet method. As a general rule, with all materials, quality of finish is better when the wet belt method is used.

TOLERANCES: As noted previously, many surfacing operations can be performed without jigs by merely holding the part against the belt and moving back and forth. Naturally such operations involve the minimum in costs but, are recommended only where close tolerances, especially parallelism, are not at issue and where stock removal is light. For close tolerances and normal or heavy stock removal operations, special jigs or holding devices and controlled power feeds are necessary.

For most operations all normal tolerances can be held—plus or minus 0.0005-inch being economically maintained by a regrinding of the support platen periodically. In some cases, plus or minus 0.00025-inch tolerances have been held although this of course often means a somewhat higher cost per piece.

Surface finish is unusually good, little or no finishing marks mar the surface. Many parts appear to be polished. With the proper grade of belt, belt speed and coolant, surface finishes from around 40 to 50 microinches to as fine as 3 microinches can be had. The finest finish with closest accuracy, however, may require two operations—a rough machining with a coarse abrasive, and finishing with a fine grit belt. Needless to say, minimum cost and maximum production are most easily achieved by specifying the widest possible tolerances commensurate with the design contemplated.

Collaboration of the following organizations in the preparation of this article is acknowledged with much appreciation:

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Porter-Cable Machine Co. (*Figs.* 3, 4 and 5)	Syracuse, N. Y.

MACHINE *Editorial* DESIGN

Materials Need Frequent Reappraisal

FEW developments in engineering have served to bring home to designers of machines the importance of materials in design as effectively as have the jet engine and gas turbine. As is generally recognized, progress in stepping up the efficiencies of these modern power plants has been dependent to a great measure on the development of metals that would stand up under severe stresses while being subjected to extremely high temperatures.

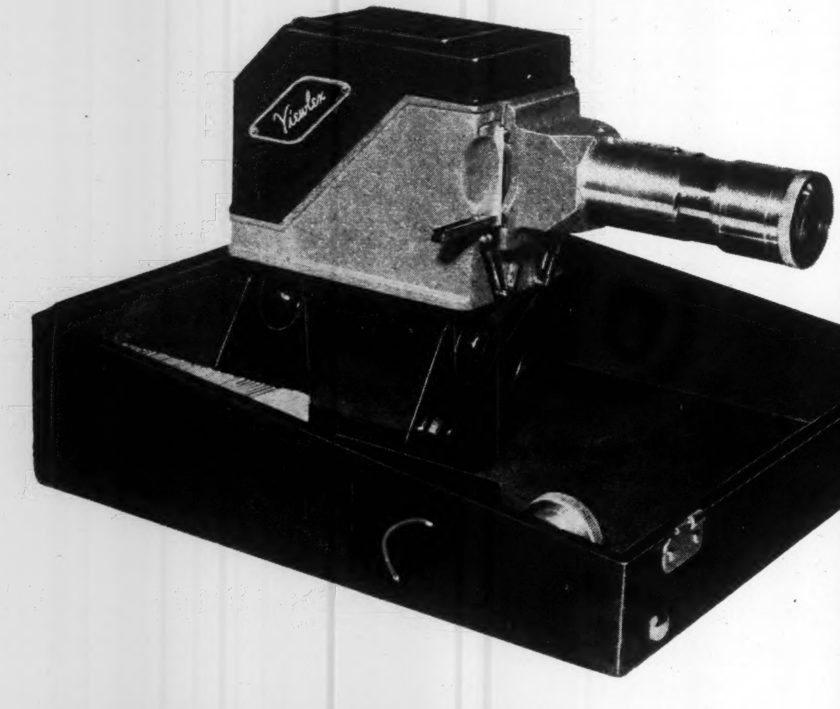
But it is well to remember that dependence of the jet engine and gas turbine on materials is not an isolated instance. Throughout the entire machine age, improvements in design and improvements in materials have necessarily progressed hand in hand. Because this will continue to be so in the future as demands increase for higher productivity, greater automaticity, quieter operation, and longer trouble-free service life, the engineer responsible for design necessarily must keep abreast of all new materials developments that are pertinent to his field.

Specification of materials that have been used successfully over and over in the past—selection based on precedent—has much to commend it. These materials are like old friends to the designer and he knows he can rely on them. In spite of this, it does not by any means follow that the oft-used materials will always be the most suitable from the standpoints of performance, first cost, processing costs, and maintenance. The new and improved materials have much to offer and their properties and characteristics should, from time to time, be compared closely with those of the familiar standbys in use.

This is particularly true where machines are produced in quantity. In such plants the alert design engineer, when refining the design of a machine, makes a particular point of reappraising carefully the materials used for all parts. By so doing he insures that top performance will be achieved at lowest cost.

MACHINE DESIGN's Directory of Materials, the thirteenth edition of which is published in this issue, can be of substantial help in such reappraisals. In the directory are listed, in quick-reference form, the familiar standbys as well as the most recently developed and improved materials of interest to designers of machines.

DESIGNS OF THE

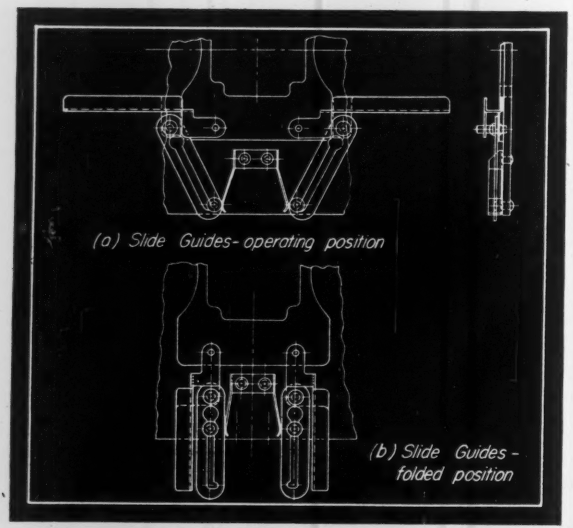


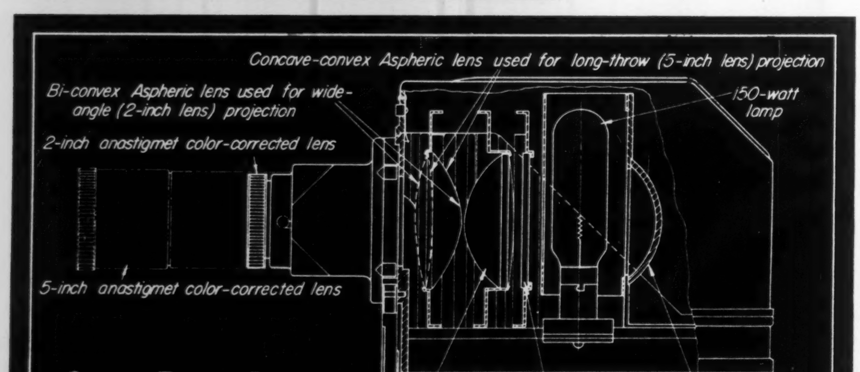
Slide Projector Employs Aspheric Lenses

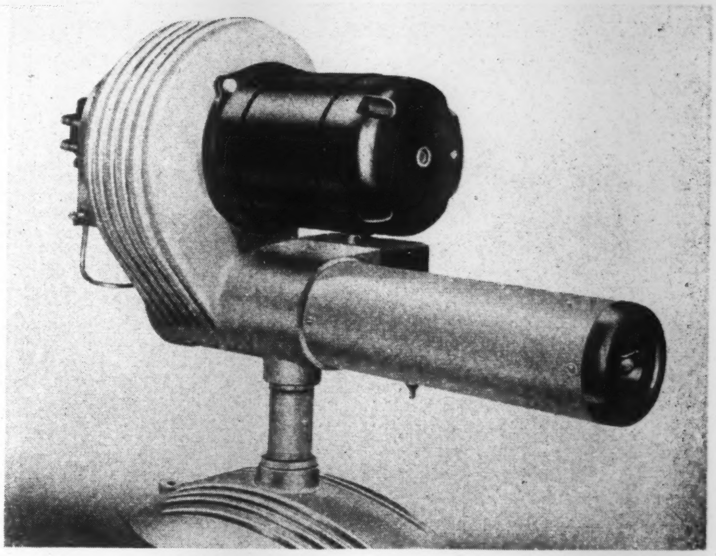
FIRST 2 by 2-inch slide projector of its type to use aspheric condenser lenses, this unit can be used for long-throw projection as well as for wide-angle, short-throw projection. The aspheric lenses help to eliminate aberrations and give the optimum in wide-angle coverage. Permanently hinged in its carrying case, the unit has slide guides which can be folded flush with the sides of the projector (see drawing) permitting it to be swung down into the case for carrying.

For wide-angle projection, the optical system comprises a rhodium reflector, 150-watt lamp, heat-absorbing glass, a biconvex lens, an aspheric biconvex lens, and a 2-inch anastigmat, color-corrected, coated lens. For long-throw projection, the biconvex aspheric lens is replaced by a concave-convex aspheric lens, and the 2-inch lens is replaced by a 5-inch anastigmat, color-corrected lens (shown in cross section).

Interchangeability plus precision location of components was an important factor in this design. The projector housing is made up of upper and lower units and a lens holder, all die cast of high-silicon aluminum alloy (tensile strength: 33,000 psi). The lower housing has accurately located vertical ribs on its inner walls for location of the condenser-lens holding frames. Two horizontal rails near the inside bottom of the lower housing provide a stop for the lens frame and also a means for holding the lamp socket, the reflector and chimney assembly, and the front and rear swivel hinges. The lens holder fits on the front of the lower housing and is aligned and held in place by three screws and two dowels. These three parts are first black-anodized all over and then wrinkle finished on the outside. Condenser lens frames, socket holder, and reflector and chimney assembly are black penetrant finished as are the swivel hinges and swivel U-base, the latter two parts receiving a final wrinkle finish except on mating surfaces. Carrying case is plywood with a covering on the outside of simulated leather and, on the inside, of felt. Rivets, links, slide carrier and carrying-case hardware are all nickel plated. Manufacturer: Viewlex Inc., Long Island City 1, N. Y.


(a) Slide Guides- operating position
(b) Slide Guides - folded position


Concave-convex Aspheric lens used for long-throw (5-inch lens) projection
Bi-convex Aspheric lens used for wide-angle (2-inch lens) projection
150-watt lamp
2-inch anastigmet color-corrected lens
5-inch anastigmet color-corrected lens
SECTION THROUGH PROJECTOR
Bi-convex lens
Heat absorbing filter
Rhodium reflector

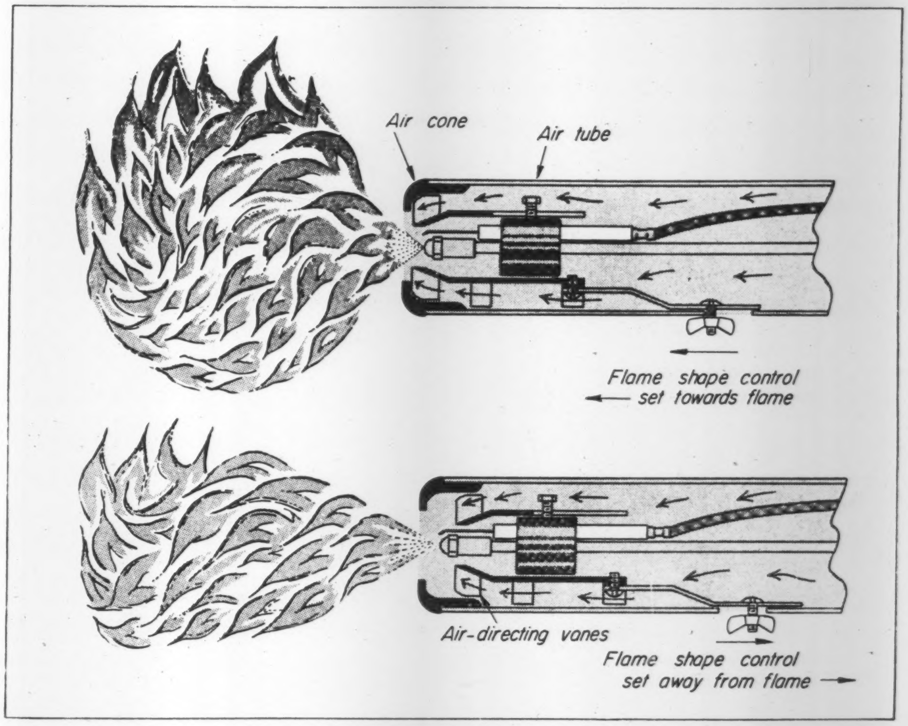


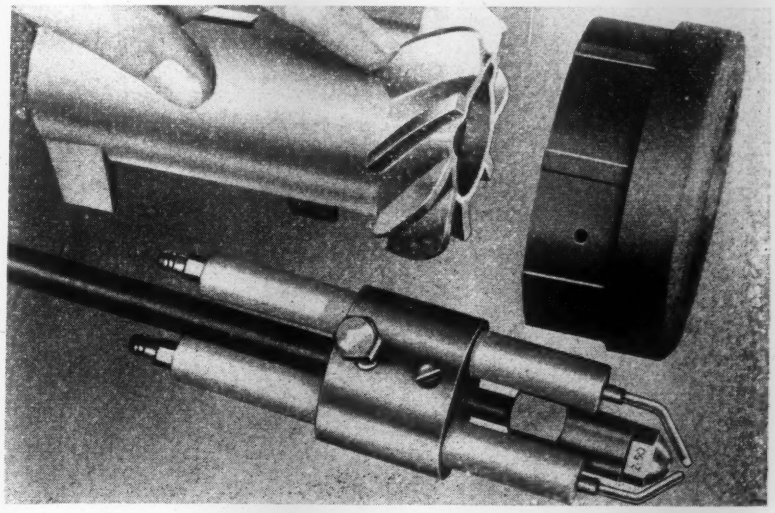
Automatic Oil Burner Features Flame Shape Control

OUTSTANDING feature of this automatic oil burner for home heating is its flame shape control which permits adjusting the shape of the flame to match the shape of the firebox employed. This control, as is shown in the schematic cross section drawings, is accomplished by moving a tube, which carries air-directing vanes, either toward or away from an air cone which encompasses the fuel nozzle and firing electrodes. This tube which carries the air-directing vanes is, in essence, the flame shape control. A wing nut, located under the air tube, loosens the control for adjusting. By sliding the control all the way forward, eight swirling jets of air are directed into the oil spray, giving the flame a hollow-cone shape. To produce a ball-shaped flame for a round firebox, the shape control unit is slid back about one-quarter inch. A long, narrow flame is produced by setting the control fully back away from the flame. Atomizing pressure normally ranges from 65 to 120 pounds.

All metal parts except those exposed to heat from the combustion chamber are aluminum. Most of parts exposed to heat are either bronze or cast iron. Specially alloyed Nichrome steel electrodes provide the firing spark and the stainless steel nozzle insures only a minimum of corrosion from the fuel oil. The unit is driven by a heavy-duty motor connected to the fuel pump by a flexible coupling, and these are the only moving parts in the unit.

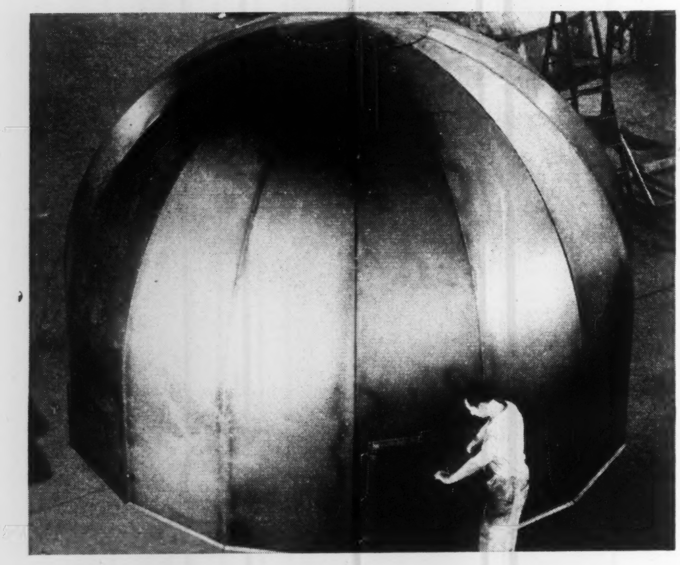
Care was exercised in designing this machine to insure maximum accessibility and easy removal of all parts and units. Motor, ignition transformer and blower wheel are built oversize to guarantee maximum trouble-free service life. In addition, wherever possible, standard components were employed. Manufacturer: The HomEase Products Div. of Bogue Electric Co., Paterson 3, N. J.


Air cone
Air tube
Flame shape control set towards flame
Air-directing vanes
Flame shape control set away from flame



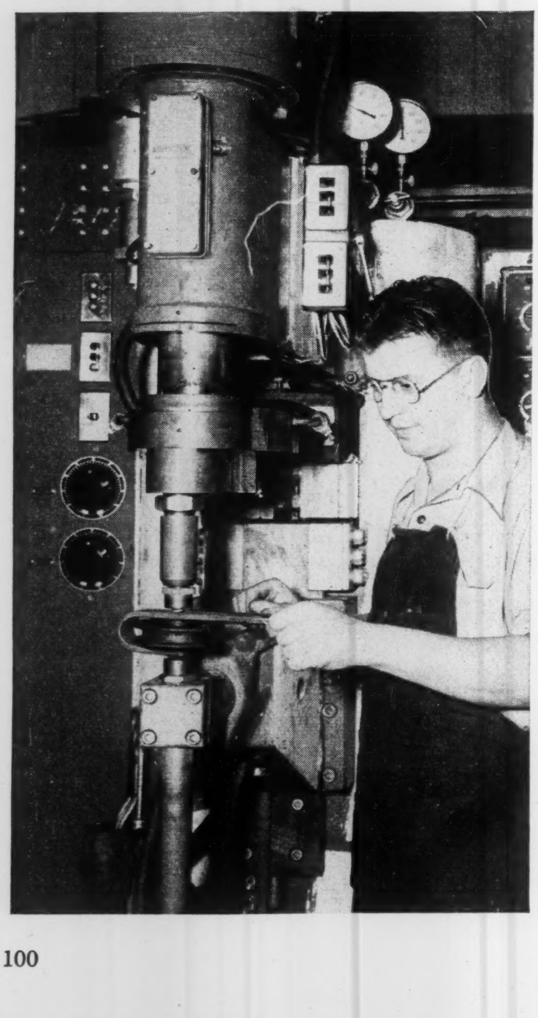
Applications

of engineering parts, materials and processes



High-Strength Enclosure Is Sheet Steel

STORAGE enclosures, left, of 16-gage mild steel, manufactured by C. E. Brandt Inc., are designed to take advantage of the inherent high strength of the hemispheroid. The unit, made for long-term storage of naval materiel, is fabricated from drawn and flanged "orange-peel" segments. The curved beam segments when welded into pairs and assembled with rubber gaskets possess great strength despite relatively low weight, and permit the container to be evacuated or filled with inert gas with little fear of damage or distortion to structure.

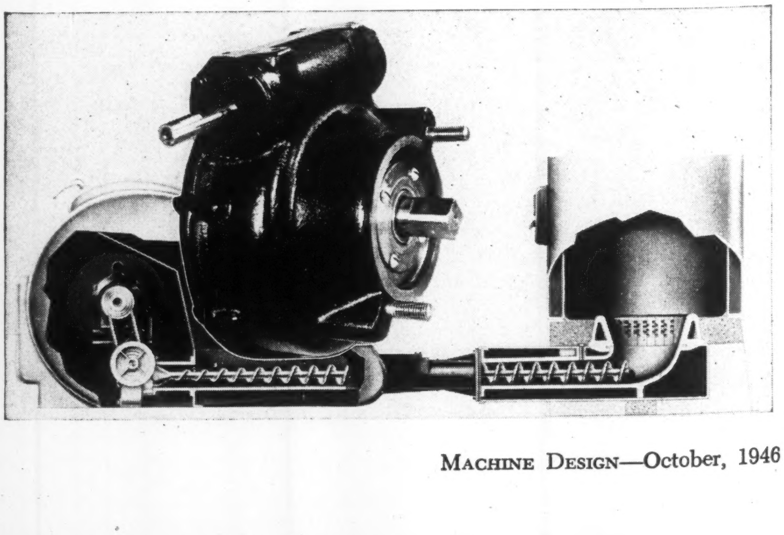


Forging by Spot-Welder Speeds Production

HOT forging of pulley axles, accomplished in the Sciaky spot-welding machine at left, increases production greatly. As seen in the illustration special electrodes are used to upset both ends of an alloy-steel axle holding the pulley in its frame. Pressure is applied to the ends of the axle, and heat regulated so as to upset only the axle ends, permitting the wheel to revolve freely in the frame without binding.

Effects Compact Drive

STOKER speed reduction unit of unusual compactness is made possible by the use of Cone gear and pinion, below. Simultaneous transmission of torque by a large number of teeth permits a gear of only 0.134 inch circular pitch, with a correspondingly small diameter to achieve the 200:1 reduction required. The Stoker Drive Co. unit illustrated is driven by a ¼-hp motor transmitting torque to the Cone-drive through a V-belt. Coal in the stoker is moved by a helicoid conveyor coupled to the gear of the reduction unit drive.



Design of Fluid-Film Bearings for Optimum Loading

By H. A. S. Howarth
Bearing Engineer
Philadelphia

Part I—For Width Equal to Diameter

ANALYSES of the operation of journal bearings with perfect lubrication have shown that the carrying capacity depends upon: Film form and thickness; average viscosity of the film; angular velocity; journal diameter; angular length of the film; and length-width ratio of the film. These relationships have been studied by several investigators and the accompanying data sheet presents concisely the net results of their findings as formulas, tables and a chart. An extensive analysis(1)* of journal bearing lubrication in two dimensions, i.e., neglecting the side leakage losses, disclosed that there was a best film form for journal bearings, just as it was known there was for pivoted shoe thrust bearings. These best film forms for journal bearings were then investigated (2) and the analysis extended to include side leakage correction factors for length-width ratios ranging from zero to four. As it appeared that these factors were not quite alike for all film forms for a given length-width ratio, a special study(3) of 120-degree centrally supported bearings was made.

With the foregoing information available, it might appear that little remained for the bearing engineer to know about designing oil-film bearings that operate with perfect lubrication. But there still remained the question that only experience can answer: "How thin is it reasonable and safe to make the minimum film thickness?"

A philosophy of variation of least film thickness with size and speed has evolved with the development of pivoted shoe thrust bearings. It demands for a given area of shoe surface a thicker film for high-speed operation than for low speed. It also demands for a given operating speed a film thickness that is not directly proportional to the linear dimensions of the surface but that tends to be relatively thicker for small surfaces than for large ones. This is a concession to the fact that deviations from perfection of face form are not proportional to the linear

TABLE I

Proposed Minimum Film Thicknesses

(for 120-degree centrally loaded clearance bearings under optimum capacity conditions)

Journal Diam. *d* (*inches*)	Proj. Area *A* (*sq in.*)	When Surface Speed Is								
		5 fps 300 fpm	10 fps 600 fpm	20 fps 1200 fpm	40 fps 2400 fpm	60 fps 3600 fpm	80 fps 4800 fpm	100 fps 6000 fpm	120 fps 7200 fpm	140 fps 8400 fpm
		Minimum Film Thickness (h_o *inches*) Should Be								
1½	2¼	.000461	.000597	.000776	.001005	.001171	.001307	.001413	.001520	.001613
3	9	.000597	.000776	.001005	.001307	.001520	.001680	.001840	.001960	.002093
4½	20¼	.000696	.000903	.001171	.001520	.001773	.001960	.002147	.002293	.002427
6	36	.000776	.001005	.001307	.001680	.001960	.002187	.002387	.002560	.002707
7½	56¼	.000843	.001093	.001413	.001840	.002147	.002387	.002600	.002773	.002933
9	81	.000904	.001171	.001520	.001960	.002293	.002560	.002773	.002973	.003160
10½	110¼	.000957	.001240	.001613	.002093	.002427	.002720	.002967	.003160	.003333
12	144	.001005	.001307	.001680	.002187	.002560	.002840	.003093	.003307	.003507
13½	182¼	.001052	.001373	.001773	.002293	.002667	.002973	.003227	.003453	.003667
15	225	.001093	.001413	.001840	.002387	.002773	.003093	.003360	.003600	.003813
16½	272¼	.001133	.001467	.001907	.002467	.002880	.003200	.003480	.003733	.003947
18	324	.001171	.001520	.001960	.002560	.002973	.003307	.003600	.003853	.004080
19½	380¼	.001207	.001560	.002027	.002640	.003067	.003413	.003707	.003973	.004213
21	441	.001240	.001613	.002093	.002720	.003160	.003507	.003813	.004080	.004333

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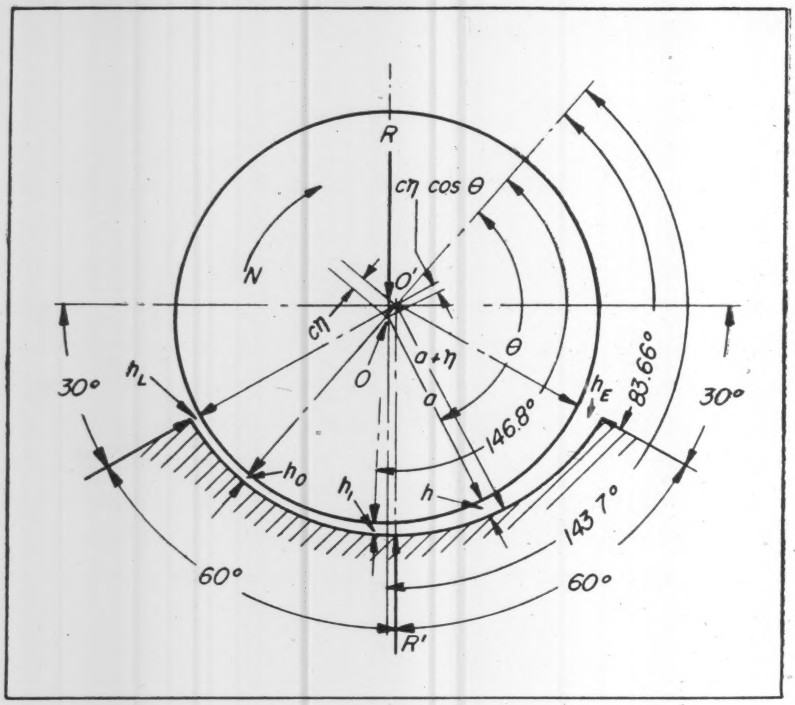
*Numbers in parentheses refer to references at end of data sheet.



$h_o = 0.531\eta$ $\qquad c = 0.469$

$h = \eta(1 + c\cos\theta)$ $\qquad V = 0.262\,N\,d$

$$\frac{P}{V}\,\frac{a}{\mu}\left(\frac{\eta}{a}\right)^2 = 0.1083 \qquad (1)$$

$$\frac{H}{PV} = 18a\left(\frac{\eta}{a}\right)10^{-6} \qquad (2)$$

$$\frac{\lambda}{\left(\frac{\eta}{a}\right)} = 2.97 \qquad (3)$$

$$\frac{\lambda}{\sqrt{\frac{\mu N}{P}}} = 0.706 \qquad (4)$$

Fig. 1—Above—Characteristics of 120-degree centrally loaded clearance bearing with width-diameter ratio of unity, optimum loading conditions

dimensions, on the average, but tend to improve relatively with increase in size.

Minimum film thicknesses for journal bearings of the centrally loaded clearance type, running under optimum load conditions, may reasonably and safely follow the values in TABLE I. They are about one-third greater than have been published for pivoted thrust shoes having the same film area and shape. The increase is proposed because the position of the least film thickness is well within the film of a centrally loaded clearance bearing instead of being at its far end as it would be for a pivoted shoe.

Two different optimum conditions are recognized(2): Maximum capacity and minimum friction coefficient. In this data sheet only those for maximum capacity are considered.

First application of the optimum load conditions will be to a 120-degree centrally loaded clearance bearing whose characteristics are shown on *Fig.* 1 for a width-diameter ratio of unity. The illustration shows the values of the important angles, which are drawn to scale, and the formulas give the relationships from which bearing performance may be calculated. The meaning of each symbol is defined in the Nomenclatures on Page 103.

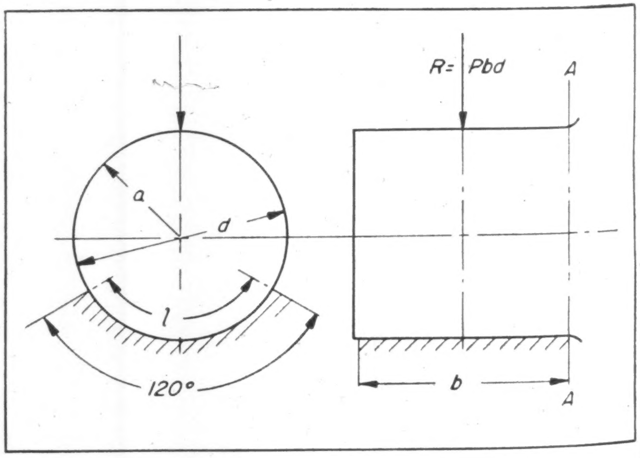
For a width-diameter ratio, b/d, equal to unity, the length-width ratio of the oil film l/b, for the 120-degree bearing is $\pi/3 = 1.047$ (*Fig.* 2). It is convenient to note that when $b = d$ the maximum bending stress for an end journal is almost exactly five times the average pressure P acting upon the projected area of the journal, *Fig.* 2.

It must be kept clearly in mind that the constants in the formulas on *Fig.* 1 will apply only to the specific bearing shown thereon. They would be different for every other length-width ratio, and for every other bearing type and angle.

Numerical values calculated from Equations 3 and 4 of *Fig.* 1 are given in TABLE II and are plotted on *Fig.* 3, which is a log-log chart designed to visualize the formulas. The table and chart may be used for quick solutions when establishing by trial the leading proportions of a proposed bearing design. It should be noted that the ZN/P values (based on the centipoise) are 6,900,000 times the $\mu N/P$ values (based on the reyn).

For estimating the power loss in a bearing film, once the clearance ratio is established, Equation 2 in *Fig.* 1 is used. It applies to optimum capacity operation and the constant is corrected for the influence of side leakage upon the power loss for a width-diameter ratio of unity. The product of pressure and velocity is

Fig. 2—Below—Proportions of 120-degree bearing. When b is equal to d, l/b = 1.047 and the maximum bending stress at section A-A is 5.093, for an end journal



ENGINEERING DATA SHEET

TABLE II

Clearance, Friction and Load-Carrying Factors

(for 120-degree centrally loaded clearance bearings under optimum capacity conditions)

$\frac{\eta}{a}$	λ	$\sqrt{\frac{\mu N}{P}}$	$\frac{\mu N}{P} \times 10^6$	$\frac{ZN}{P}$
.0001	.000297	.000421	0.177	1.224
.0002	.000594	.000842	0.709	4.890
.0003	.000891	.001263	1.595	11.00
.0004	.001188	.001684	2.830	19.54
.0005	.001485	.002105	4.430	30.60
.0006	.001782	.002526	6.375	44.00
.0007	.002079	.002947	8.685	59.90
.0008	.002376	.003368	11.35	78.30
.0009	.002673	.003789	14.38	99.20
.0010	.002970	.004210	17.72	122.40
.0012	.003564	.005052	25.50	176.0
.0014	.004158	.005894	34.75	240.0
.0016	.004752	.006736	45.40	313.0
.0018	.005346	.007578	57.50	397.0
.0020	.005940	.008420	70.90	489.0

a factor in the power loss, just the same as the product of velocity and viscosity is a factor in determining the bearing capacity.

In next month's data sheet correction factors for width-diameter ratios other than unity will be presented, together with a chart illustrating current practice regarding the relationship between pressure and velocity in bearings. Examples will illustrate how to apply the information obtained from both data sheets.

NOMENCLATURE

A = Projected area of journal, sq in., = $2\,ab = db$

a = Radius of journal, inches, = $d/2$

b = Width of supporting bearing, inches measured axially

c = Factor of eccentricity of journal in the bearing

d = Diameter of journal, inches, = $2a$

F_1 = Side leakage correction factor for friction

H = Horsepower of journal friction per unit of width b

h = Film thickness, inches, at any angular position, *Fig.* 1.

h_o = Least film thickness, inches measured on line of centers OO', *Fig.* 1

h_1 = Film thickness, inches, at region of maximum pressure p_1

L_1 = Side leakage correction factor for load-carrying capacity

N = Revolutions per minute

P = Average pressure, psi, over projected area for journal

R = Total load of journal upon the bearing, pounds

V = Velocity of moving surface, feet per minute

W = Load capacity per unit of bearing width = R/b, pounds

Z = Absolute viscosity, centipoises

μ = Absolute viscosity, reyns (lb-sec per sq in.)

λ = Coefficient of friction

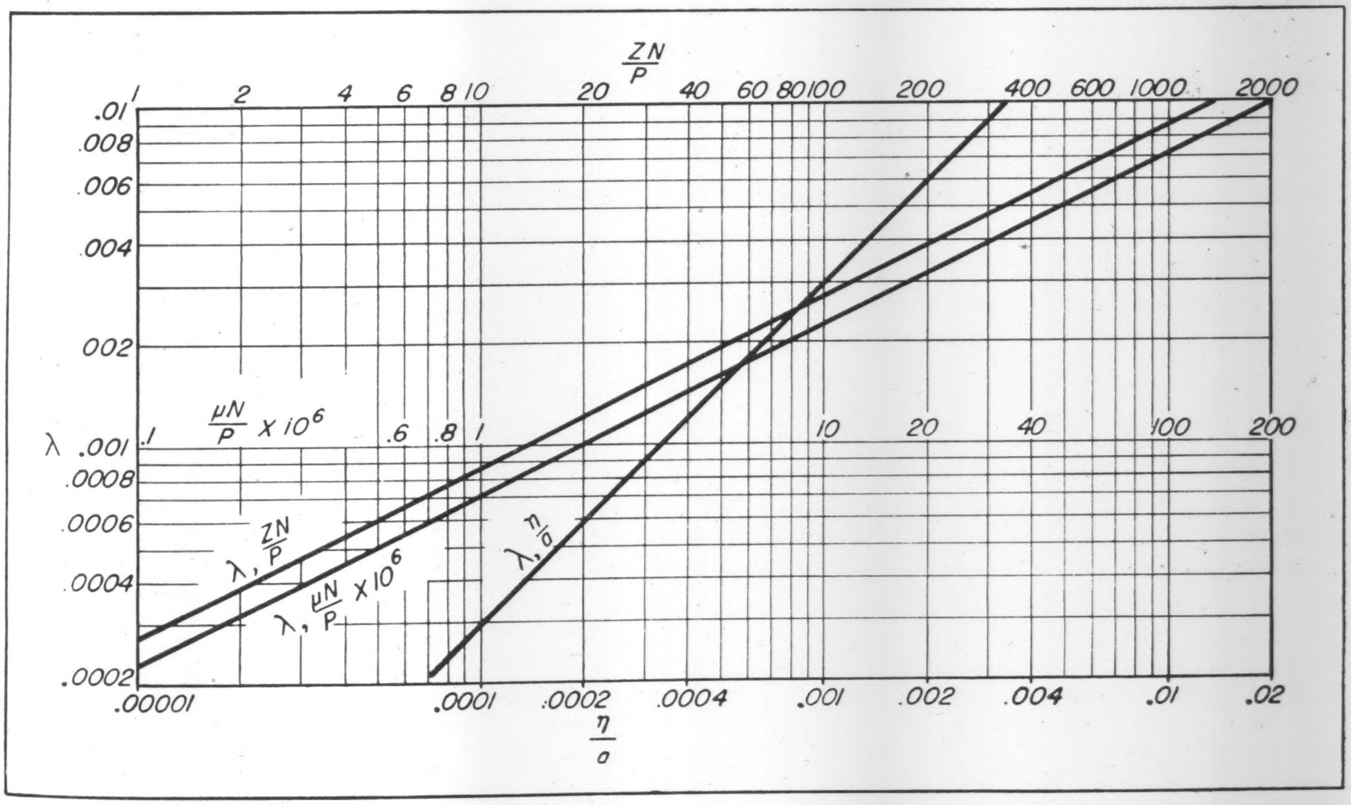
θ = Angle to position in film where thickness is h, *Fig.* 1

η = Radial Clearance, bored in the bearing. Bearing radius = $a + \eta$.

REFERENCES

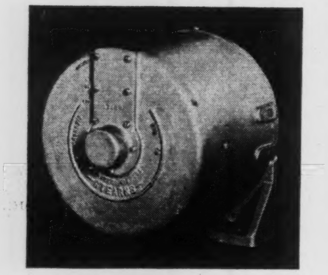
1. H. A. S. Howarth—"A Graphical Analysis of Journal Bearing Lubrication", *A.S.M.E. Transactions*, Vol. 45 1923, Page 421; Vol. 46, 1924, Page 809; Vol. 47, 1925, Page 1073.
2. Albert Kingsbury—"Optimum Conditions in Journal Bearings", *A.S. M E. Transactions*, Vol. 54, Paper RP-54-7, 1932, Page 123.
3. Sydney J. Needs—"Effects of Side Leakage in 120-Degree Centrally Supported Journal Bearings", *A.S.M.E. Transactions*, Vol. 56, Paper APM-56-16, 1934, Page 721.

Fig. 3—Clearance, friction and load capacity factors for 120-degree centrally loaded clearance bearing with a width-diameter ratio of b/d=1



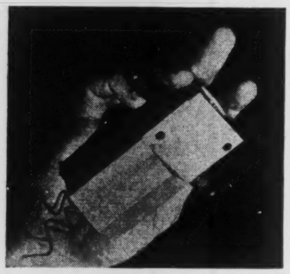
new parts and materials

Magnetic Disk Brake



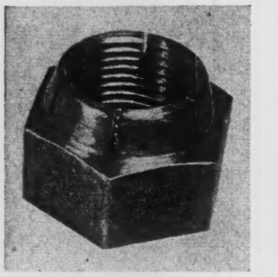
ANNOUNCED by Stearns Magnetic Mfg. Co., Milwaukee 4, a new magnetic disk brake known as Series 1300 is designed for use on applications up to 100 hp loads and augments present Series 800 and 1000 brakes. The Series 1300 brake can be supplied in either floor or motor-mounted types and for either alternating or direct current. Simplified design provides easy replacement of any part where necessary, without disturbing brake assembly.

Solenoid Operated Valve



TWO-WAY valve, solenoid-operated, has been announced by Electrol, Inc., 85 Grand St., Kingston, N. Y. The device accommodates flow up to 2 gpm with a pressure range up to 1500 psi. Solenoid energization is obtained by 12-24 volts direct current. Made of anodized aluminum alloy bar stock, the valve weighs 1¼ lb and measures 3 9/16 inches long by 1¾ inches. One-eighth inch female National Pipe Thread fittings accommodate piping.

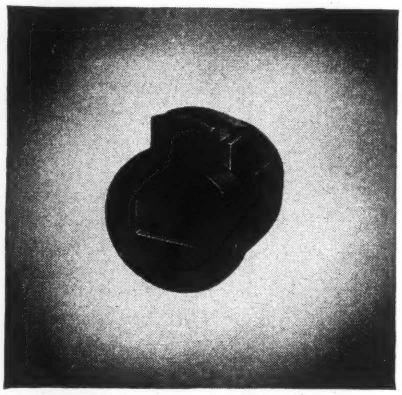
New Locknut



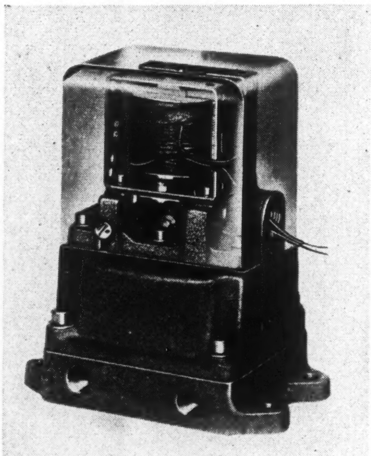
NOVEL TYPE of locknut of one-piece metal construction said to be unaffected by high temperatures, oil or other types of moisture has been announced by the National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4. The fastener known as the Huglock nut is formed with a slotted tapered top and threaded the full nut thickness. The upper portion or crown of the nut is so curved that the six tapered threaded segments press inwardly against the bolt and at the same time set up a downward pressure on the bolt threads, producing friction lock between the load carrying flanks of the nut and bolt threads. Controlled preset torque permits the nut to grip the bolt firmly whether seated or not until removed with a wrench. Need for drilled holes, cotter pins, lock washers, or other secondary locking devices is obviated. Huglock nuts are available in a full range of sizes of American Standard Light, and American Standard Light Thick. They are also available in alloy steel.

Wire Strain Relief

ANNOUNCED by the Heyman Manufacturing Co., 70 Michigan Ave., Kenilworth, N. J., is a plastic strain relief for wires. Known as Heyco No. 4, the molded, heat-resistant plastic unit will absorb pull, push and torque from the cord set, and eliminate all strain on the terminals. Making sewing and knot tying unnecessary, the relief is said to prevent wire fraying and to act as an insulation grommet.

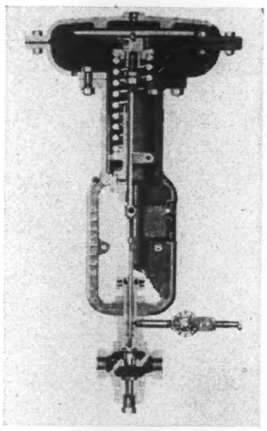


Three-Way Solenoid Valve



SOLENOID - controlled a new Numatics three-way valve announced by Numatics, Milford, Mich., draws less than 3 amperes at 110 volts. The unit is a full-ported poppet type providing straight-line air flow control with few working parts and very little mechanical action. Short plunger travel—7/64-inch — along with simplicity of mechanism is said to eliminate pounding and harsh action resulting in long life. Reversing supply and outlet manifolds on the center body can vary desired setup, making the unit open to exhaust and closed to pressure or open to pressure and closed to exhaust. Valves can be mounted in any position. Units are available in six sizes ranging from ¼-inch to 1¼ inch, to handle operating pressures from 0 to 150 lb. Larger sizes can also be furnished by manufacturer upon request.

Control Valve

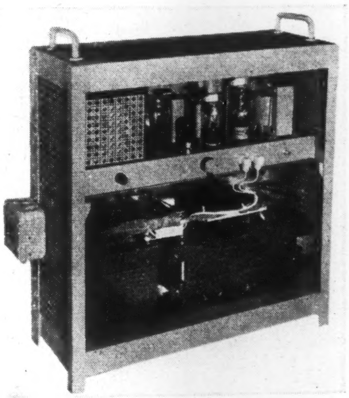


PILOT PISTON control valves having a linear-logarithmic relationship between the flow and valve lift are announced by the H. Belfield Co., 435 N. Broad St., Philadelphia 23. The Belfield pilot system uses a wide-range controlled disk with an equal percentage characteristic having the property that change in flow is expressible in terms of per cent of flow before change. Peculiarity of this characteristic is that these percentages are always equal. Featuring precision molded diaphragm, high-alloy steel springs, and valve body suitable for high fluid velocity, the units are available to fit ½, ¾ and 1-inch pipe sizes. Pilot pistons are available with overlapping characteristics so as to provide effective control over a wide range of flows.

Miniature Steel Balls

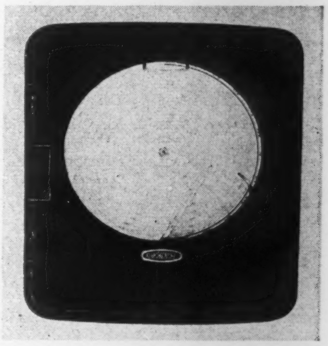
ANNOUNCEMENT of high-precision steel balls half the size of a pinhead has been made by SKF Industries, Inc., Front St. and Erie Ave., Philadelphia. One millimeter in diameter, the balls were designed especially for new-type fountain pens but are applicable to delicate instruments, bearings, etc. The balls are made to extremely fine tolerances averaging within 0.000005-inch of being perfectly round and having a diameter variation of 0.00005-inch or less. Balls are made from high carbon and chromium wire.

Voltage Regulator



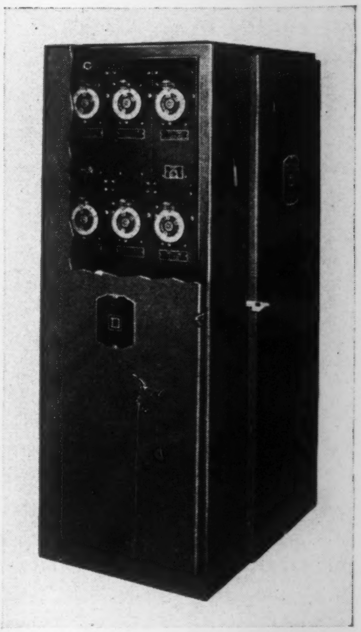
THE SORENSEN Model 5000-2 electronic voltage regulator is designed for nominal 230 volt applications within the load range of 500 va to 5 kva. It stabilizes line voltage variations with an accuracy of plus or minus 0.25 per cent independently of load variations within the rated range. Unaffected by lagging power factor variations or frequency changes between 50 and 70 cycles, the regulator is said to be particularly suited as a stable voltage source where poorly regulated or auxiliary power supplies must be used. The unit which is manufactured by Sorensen & Co. Inc., 375 Fairfield Ave., Stamford, Conn., is regulated electronically, giving it the advantages of quick transient response and long life. Harmonic distortion of the output wave is said to be less than 5 per cent total.

Process Controller



MODEL 40 controller identifies a new improved instrument for the control of temperature, pressure, flow and other continuous processes variables. Manufactured by the Foxboro Co., Foxboro, Mass., the unit supersedes and is an improvement upon Model 30 introduced several years ago. The new model may be generalized as a simplification of design with more sturdy unit construction resulting in superior performance, easier and more flexible adjustments, and convenience in servicing, to include the easy replacement or interchange of unit parts. Model 40 is made as an indicator as well as single-pen and multipen recorder, and is available for such actions as on-off control, proportional, proportional and reset, proportional with derivative, and proportional and reset with derivative. The case is die-cast aluminum, with openings sealed dust tight.

Combination Welder Control



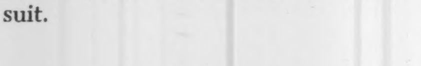
FULLY AUTOMATIC control of air-operated resistance welding machines is provided in Class 8992 combination control unit recently announced by the Square D Co., 4041 N. Richards St., Milwaukee 12. A syncro-break welder contactor and Safront sequence-weld timer are both included in a single encloser arranged to mount on the the right side of the machine with all control elements within easy reach of the operator. More convenient adjustment, better appearance, less expensive and more flexible installation, and safer operation are advantages presented by the manufacturer. Controllers are designed with a control circuit which may be separate or common with the power circuit. Solenoid air valve may be energized from either power or control supply sources by simple reconnection. Controllers have tapped primary control transformers for operation at 110, 220, or 440 volts at 60 cycles; or for 380 volts, 50 cycles. Foot switch, pressure switch, noweld switch and timer-control circuits operate at 110 volts and are isolated from the power supply to give the operator added safety. A metal barrier between contactor and timer sections of the enclosure eliminates any possibility of flash-over between the power and control circuits. Space and terminals are provided within the standard controllers for additional features such as 24 volt initiating switch control, two-stage pilot switch control, or 24 volt two-stage pilot switch control.

Automatic Air Valve

AUTOMATIC air valve designed to speed up pneumatic cylinder action has been announced by the Bryant Products Co., Jackson, Mich. The valve lets air into the cylinder, then when the three-way valve is operated it automatically opens a port at the cylinder for exhaust. The valve is said to speed up cylinder action from 50 to 200 per cent depending upon how far the operating valve is from the cylinder. The valves are designed to match operating valves, and are provided with thread types to suit.

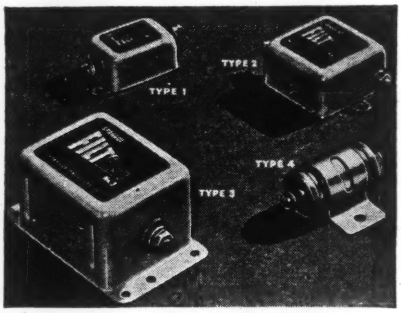
Hydraulic Fuze

DESIGNED as a safety shut-off device to prevent excessive loss of hydraulic fluid in the event of line breakage or rupture, the return flow fuse manufactured by Simmonds Products, Inc., 21-10 49th Avenue, Long Island City, N. Y., provides protection for hydraulic lines on machine tools, earth movers, and similar equipment. Installed between the pressure and return line, this type fuse shuts off only if a break in one of the two lines causes a pressure drop below predetermined values. Under normal operating conditions the fuse remains open by means of poppets, one in each line, counter-balancing each other. The poppets measure flow by balancing pressure drops through orifices in the poppets and are not sensitive to the actual pressures involved. When flow in the pressure and return lines becomes unbalanced due to a break or leak in line, forces across the two poppets also become unbalanced and poppets will seat and shut off the flow. Weighing approximately 1½ pounds, units are available for lines from ¼ to ¾-in. OD and in capacities from 5 to 100 cubic inches.



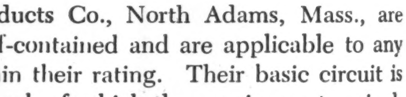
Interference Filters

RECENTLY announced, Filterol radio-interference filters are designed for installation in series with power line or interfering device. The units, which are manufactured by the Sprague Products Co., North Adams, Mass., are small, completely self-contained and are applicable to any electrical device within their rating. Their basic circuit is a three-terminal network of which the can is one terminal. Four available types include 115 volts ac or dc ratings from 1 to 35 amperes, and one unit for 220 volts ac or dc current rated at 20 amperes.



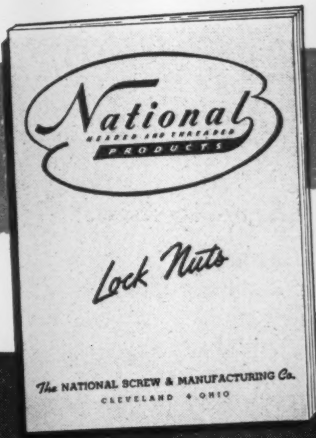
300 Ampere Solenoid Starter

SIZE 5, Bulletin 709 solenoid starter rated 100 hp at 220 volts and 200 hp at 440-600 volts has been announced by Allen-Bradley Co., 1311 S. First St., Milwaukee. The new unit replaces the older Bulletin 710, Size 5, clapper starter. Features of the smaller solenoid starters are incorporated in the new Size 5 starter. Contact cleaning, filing or dressing is obviated by the use of cadmium-silver contacts. There are no bearings, pivots, or hinges. The double-break cadmium-silver contacts are totally enclosed in an arc hood, each pole of the switch having its individual arc chamber. The starters can therefore be closely grouped without danger of flash-over be-



Select the right lock nut

with this new help...



Whatever your lock nut problem, one of these 4 distinct types should be exactly right for your particular job:

National "Drake" Lock Nuts

Two-piece, positive lock, especially suitable for heavy-duty applications where unusually severe stress, shock or vibration is encountered.

National "Dynamic" Lock Nuts

Thin, shear nut with diaphragm lock, for applications where a thin, one-piece locking medium of light weight is necessary and where strains would be in shear only.

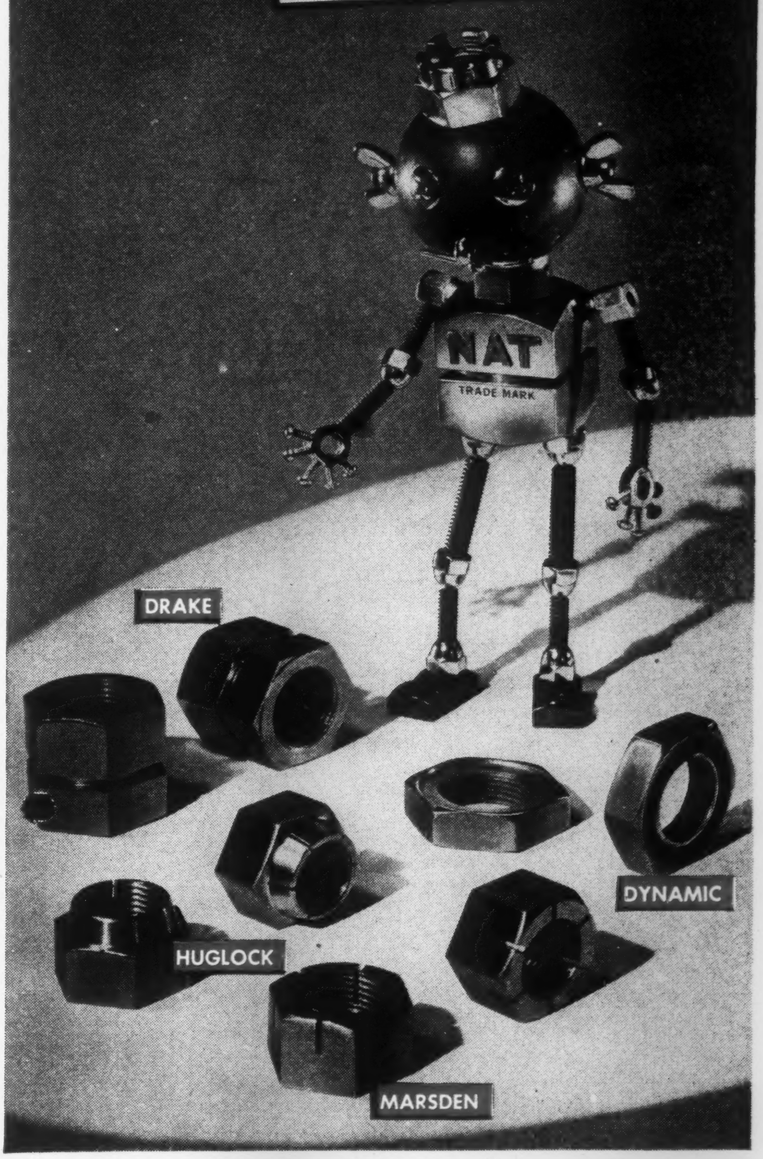
National "Huglock" Nuts

One-piece, all-metal lock nut—the self-locking pre-set torque values are built in and insure vibration-proof results on all applications, even where high temperatures, oil or other types of moisture are involved.

National "Marsden" Lock Nuts

One-piece, cantilever action type-designed for effective locking action with minimum cost. Easily applied, free running until seated.

May we send you complete information? A request on your letterhead will bring you the new Lock Nut Catalog, without any obligation. Please send for it today.



Other "National Screw" Specialties include:

- **Clutch Head Screws**
- **Hi-Shear Rivet Pins & Collars**
- **Laminar Flow Screws**
- **Lok-Thred Studs**
- **Phillips Recessed Screws**
- **Rosán Locking System**
- **Scrivets**
- **Sems**

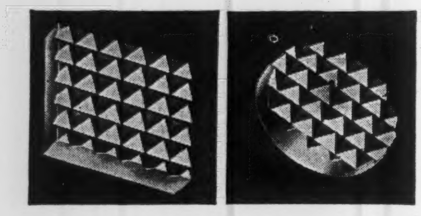
National
Headed and Threaded
Products

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

tween switches, arc-interrupting capacity is very high—currents of at least ten times the maximum horsepower rating are interrupted. Starter is mounted on a self-insulated metal base plate mountable on any surface without extra insulation, and is made with or without enclosure. Enclosed starter is available in any NEMA Type 1 sheet metal enclosure, as well as NEMA Type 4 water-tight and weatherproof, and NEMA Type 5 for nonhazardous dust.

Gripping Inserts

USEFUL IN various holding, clamping, and feeding devices, a new line of durable gripping inserts made of Kennametal have been announced by Kennametal Inc., Latrobe, Pa. The units known as Kengrips are made in the form of disks and squares with diamond-serrated surfaces. Four sizes are available in either form; ½ in. x ⅛ in. ⅝ in. x ⅛ in., ¾ in. x 5/32 in., and 1 in. x 5/32 in. thick.

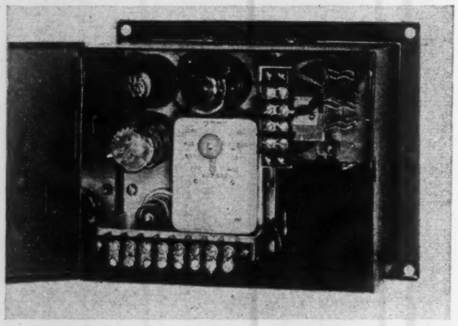


New Welding Electrode

COATED beryllium-copper electrode known as Beryl-Trode is the latest copper-base alloy electrode announced by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4. The electrodes, which are made in two diameters—5/32 and 3/16-inch—in 14 inch lengths, have medium weight flux coating required for stabilizing the arc and produce a dense deposit.

Thermal Protector

THERMAL COUPLE actuated limit switch providing protection for excessive temperature or failure of service is announced by Manning, Maxwell & Moore, Inc., Bridgeport, Conn. The thermal protector is designed with two ranges, 100 to 1000 F using an IC couple, and 800 to 2000 F using an AC couple with an accuracy of 2 per cent of the range at a set point. Two or more couples may be connected in a series if desired. The cold junction is located in the unit and is compensated to ambient temperatures of 50 to 135 F and a relative humidity up to 100 per cent. The current characteristics are 115-230 volts, 60 cycle ac, 15-20 watts. There are no open contacts in the device and the circuit for the signal and power input to the apparatus is a standard 4-ampere 250-volt mercury switch. The unit, which can be used in industrial ovens, dryers, motor bearings, plastic presses, etc., is provided with an operating knob inside the case with which the high limit temperature is set. If this temperature is reached the device will stop the apparatus before excessive damage is done, or it can be arranged to alarm.



Protective Coating

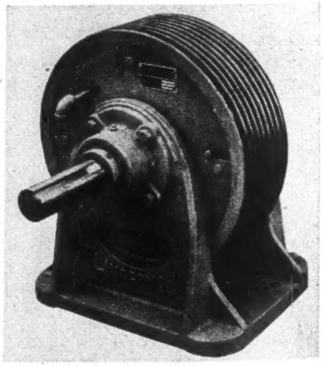
BLACK protective coatings available in a number of types have been announced by Watson-Standard Co., 225 Galveston Ave., Pittsburgh 12. Organic finishes, the coatings are suited to a variety of purposes and to application methods such as spraying, dipping, air drying and baking.

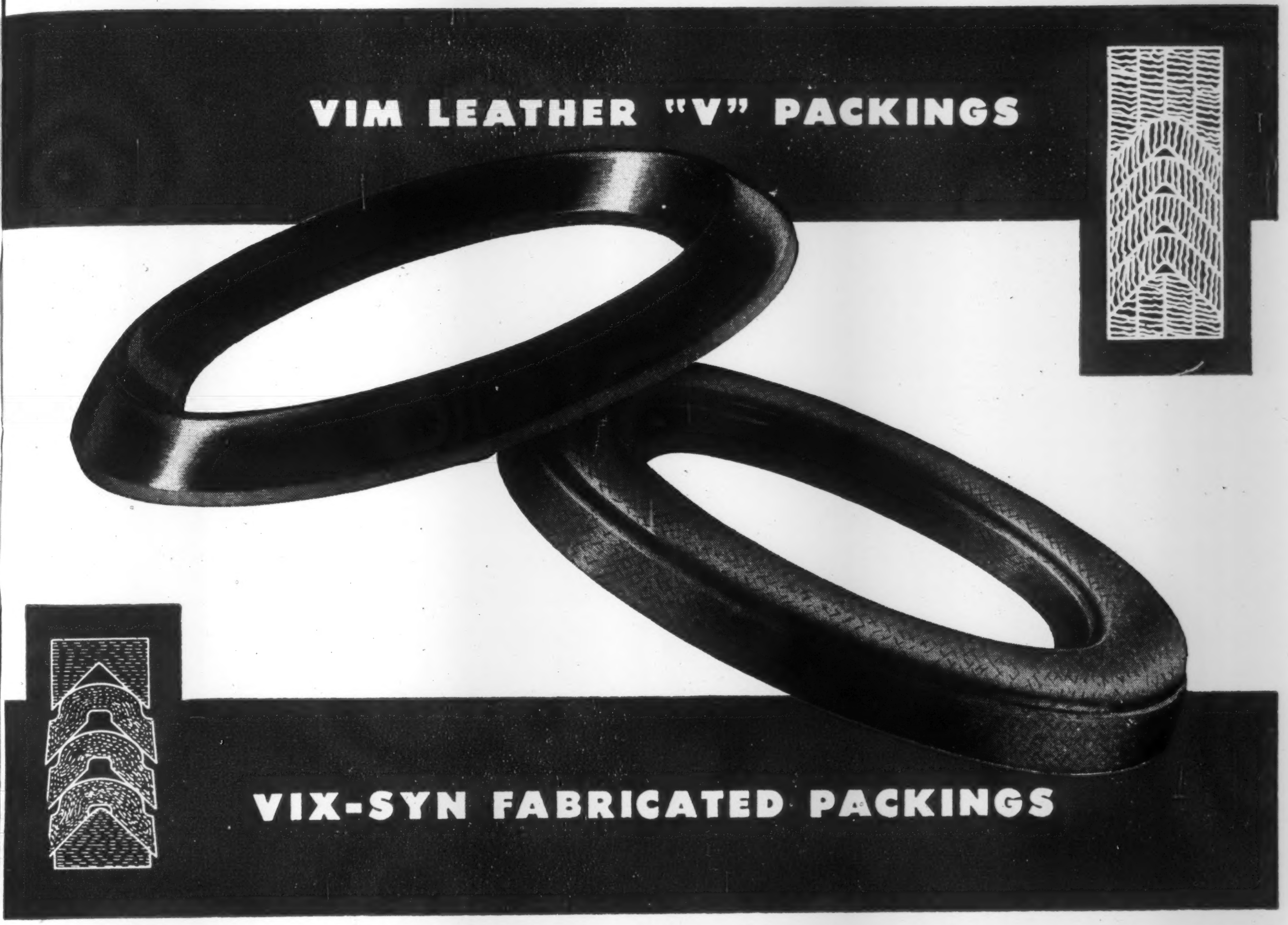
Hermetic Compressor

HAVING approximately one third the weight of present day conventional units, a new compressor no larger than a quart milk bottle has been announced by Jack & Heintz Precision Industries, Inc., Cleveland. Development is now reaching completion on units of ⅛ and 1/6-hp covering the household refrigeration field in 7 to 9 cubic foot sizes. Other models are being developed in the laboratory for commercial applications such as water coolers, beverage coolers, home freezers, window-type air conditioning units, etc. Experimental installations have indicated many desirable advantages—particularly compact simple installations—while the small size and lightness in weight have been accomplished without sacrificing efficiency, reliability or endurance life of the unit.

Friction Brake

LINE OF BRAKES designed to apply accurately-controlled continuous tension in industrial machinery has been announced by Linderman Devices Inc., Newburgh, N. Y. Features of the brake which make it suitable for applying continuous retarding force are the absence of self-energizing action, ability to apply heavy loads under ordinary factory airline pressures, radial-shoe action, and use of 90 per cent of the drum area for braking. The





Houghton offers both, and will recommend the type best suited to your need . . .

Two popular types, these — VIM Leather "V" Packings, especially effective against medium and high pressures, and VIX-SYN Fabricated Packings, for low and medium pressures and high temperatures.

Each is supplied in sets, with top and bottom rings of the same material — leather laminated supports for VIM, and fabricated rings for the synthetics.

Each has its place in the holding of hydraulic or pneumatic pressure. The plus value in these packings is the advice given by our engineers who are available for proper design or maintenance recommendations.

You tell us your problem; we'll impartially recommend the best packing for the job. E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.

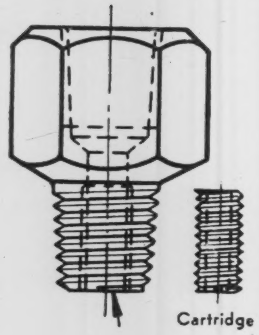
Write for Specification Sheets D-37 and S-1 covering above packing sets

HOUGHTON'S

VIM Leather and **VIX-SYN** Packings

unit is air actuated and increases or decreases in tension are obtained by merely changing the gage setting. Brakes have been installed for applying continuous retarding action in such machines as paper mills, textile machinery and sheet-metal strip mills.

Cartridge Snubber



PULSATION dampener of a new type has been announced by the Helicoid Gage Division of American Chain & Cable Co. Inc., Bridgeport, Conn. The device, which is effective for reducing or eliminating fluid pulsation, takes advantage of the use of powder metal through which the pressure medium must pass. Compressed powder metal is in the form of a cartridge which can be inserted direct in the gage socket or in a small separate connecting piece attached to the socket. The powder metal is made in various porosities for air or gas, for water or steam, or for oil.

Helical Potentiometer

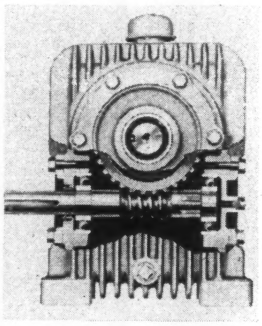
MICROPOT
GIBBS

NEW TYPE precision ten-turn helical potentiometers, linear within 0.10 per cent and with resistance values from 500 to 30,000 ohms have been announced by Thomas B. Gibbs & Co., Division of the Geo. W. Borg Corp., Delavan, Wis. Meauring 2⅛ inches in diameter and 2⅛ inches long, the unit is molded of plastic with terminals molded in. The unit has a running torque less than 1½ ounce-inches at room temperature and not exceeding 3 ounce-inches between − 55 and + 77 C.

Rectifier

MINIATURE selenium rectifier to replace rectifier tubes in portable and car radios has been announced by the Tungar & Metallic Rectifier Division of the General Electric Co. Tests show the operating life expectancy of the midget rectifier to be many times that of the conventional 117-volt filament tube which it replaces. Made entirely of metal, it will withstand rougher handling than the tube. Consisting of five selenium disks made on aluminum base plates connected in series, the rectifier measures 1 inch in diameter and ¾-inches in length. Having no heat producing filament the rectifier eliminates excessive heat. It is designed to withstand safely the inverse-peak voltages obtained when rectifying half-wave 110-120 volts rms and feeding into a capacitor. Continuous currents, up to 100 milliamperes can be obtained.

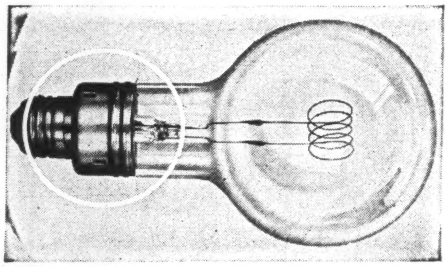
Speed Reducer



COMPLETE standardized line of compact speed reducers built around double enveloping Cone-drive gearing is announced by Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12. The new standardized line includes models with pinion under, pinion over, and with gear shaft vertical. The center distances range from 2 to 18 inches with horsepower ratings up to 800 hp input to the pinion. Thermal capacities assuring longer service life are increased by the use of finned housings transferring the heat to the atmosphere. Splash type oiling is used on all standard reducers.

Infra-Red Lamps

CARBON-FILAMENT infrared drying lamps manufactured by the North American Electric Lamp Co., 1014 Tyler St., St. Louis 6, are now available with mechanical screw bases. The new type base which eliminates need for cements or other binders is said to assure maximum lamp life under high heat conditions and provides a permanent seal under all circumstances. Clear type lamp is furnished in 128, 250, 375 and 500 watts sizes. Inside silvered R-40 lamps are available in 128,250 and 375 watts.



Pneumatic Cylinders

DIVERSIFIED use of same units is made possible with new pneumatic cylinders manufactured by the Modernair Corp., 4222 Hollis St., Oakland 8, Calif. Tie rods have been eliminated transferring tension to the cylinder wall, and caps are made of heat-treated aluminum-alloy sand castings. Important features of the new unit are the ability of the caps to rotate a full 360 degrees on the cylinder

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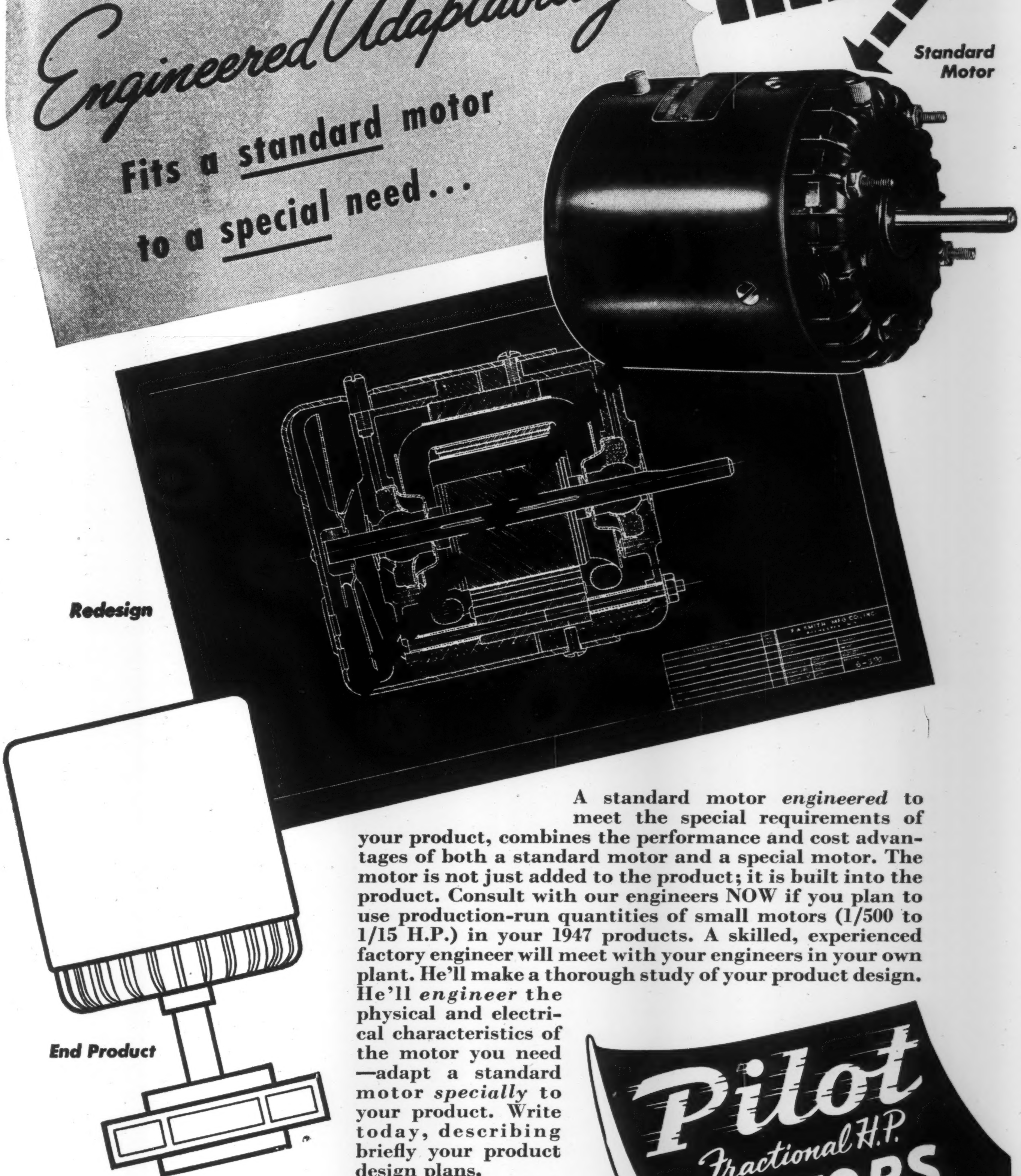
Engineered Adaptability

Fits a standard motor to a special need...



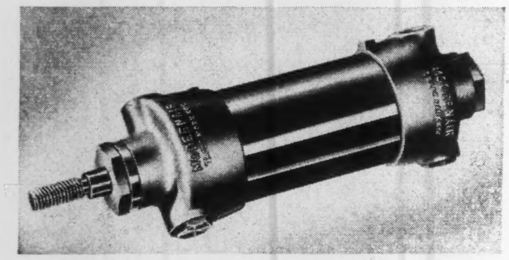
A standard motor *engineered* to meet the special requirements of your product, combines the performance and cost advantages of both a standard motor and a special motor. The motor is not just added to the product; it is built into the product. Consult with our engineers NOW if you plan to use production-run quantities of small motors (1/500 to 1/15 H.P.) in your 1947 products. A skilled, experienced factory engineer will meet with your engineers in your own plant. He'll make a thorough study of your product design. He'll *engineer* the physical and electrical characteristics of the motor you need—adapt a standard motor *specially* to your product. Write today, describing briefly your product design plans.

Pilot
Fractional H.P.
MOTORS & BLOWERS

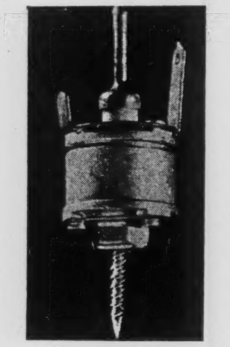
F. A. SMITH MANUFACTURING CO., INC.
550 DAVIS STREET ROCHESTER 2, N. Y.

FASCO

without disturbing the seal, and O-ring packings throughout the cylinder at all points of wear or possible leakage. The former feature has the advantage of simplifying plumbing, eliminating the need for elbow or T-fittings to bring a line into or out of the cylinder. The O-rings eliminate metal to metal contact at wear points. The unit may thus be completely renewed by replacing the easily serviced ring. Cylinder is corrosion resistant and can be made for actuation by air, water or oil. Standard design incorporates a self-regulating cushion, however, an adjustable cushion can be furnished.

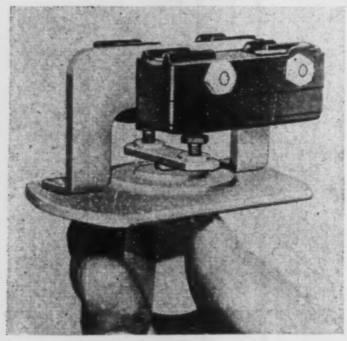


High Q Trimmer



CAPACITOR consisting of concentric aluminum cylinders moved relatively along a common axis by means of a screw has been announced by North American Philips Co. Inc., 100 East 42nd St., New York. Less than ½-inch in diameter and 1 7/16 inches in length, the units known as Hi-Q trimmers are said to be useful for trimming or tuning beyond 500 megacycles. Capacitance range is 3 to 30 mmf and linear relationship covers 27 mmf over three full rotations. Selected settings remain permanent by virtue of a special retention spring, vibration does not disturb capacitance because of a long rotor-bearing sleeve closely hugging a matching central ceramic insulator.

Differential Electric Switch



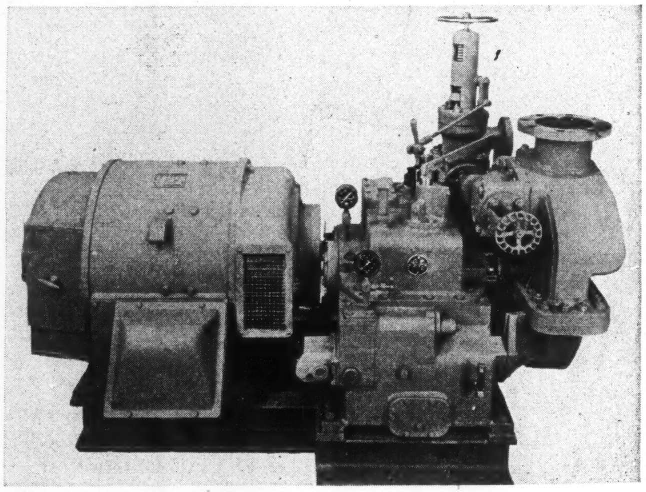
PRESSURE - ACTUATED switch controlling two electric circuits at equal or differential pressures is announced by Cook Electric Co., 2700 Southport Ave., Chicago 14. Actuated by Spring Life bellows are two snap - action switches which may be adjusted to high and low operating characteristics. In this manner switch A can be set to operate for normal conditions while switch B is free to operate safety controls. Either circuit of the switch may be supplied to operate on pressures from 1 to 17 psi. Nominal value of pressure differential between on and off positions may be specified anywhere between 1 and 10 psi. The unit is rated at 10 amperes 120 volts ac, weighs 8 ounces and is supplied with a ¼-inch pipe threads.

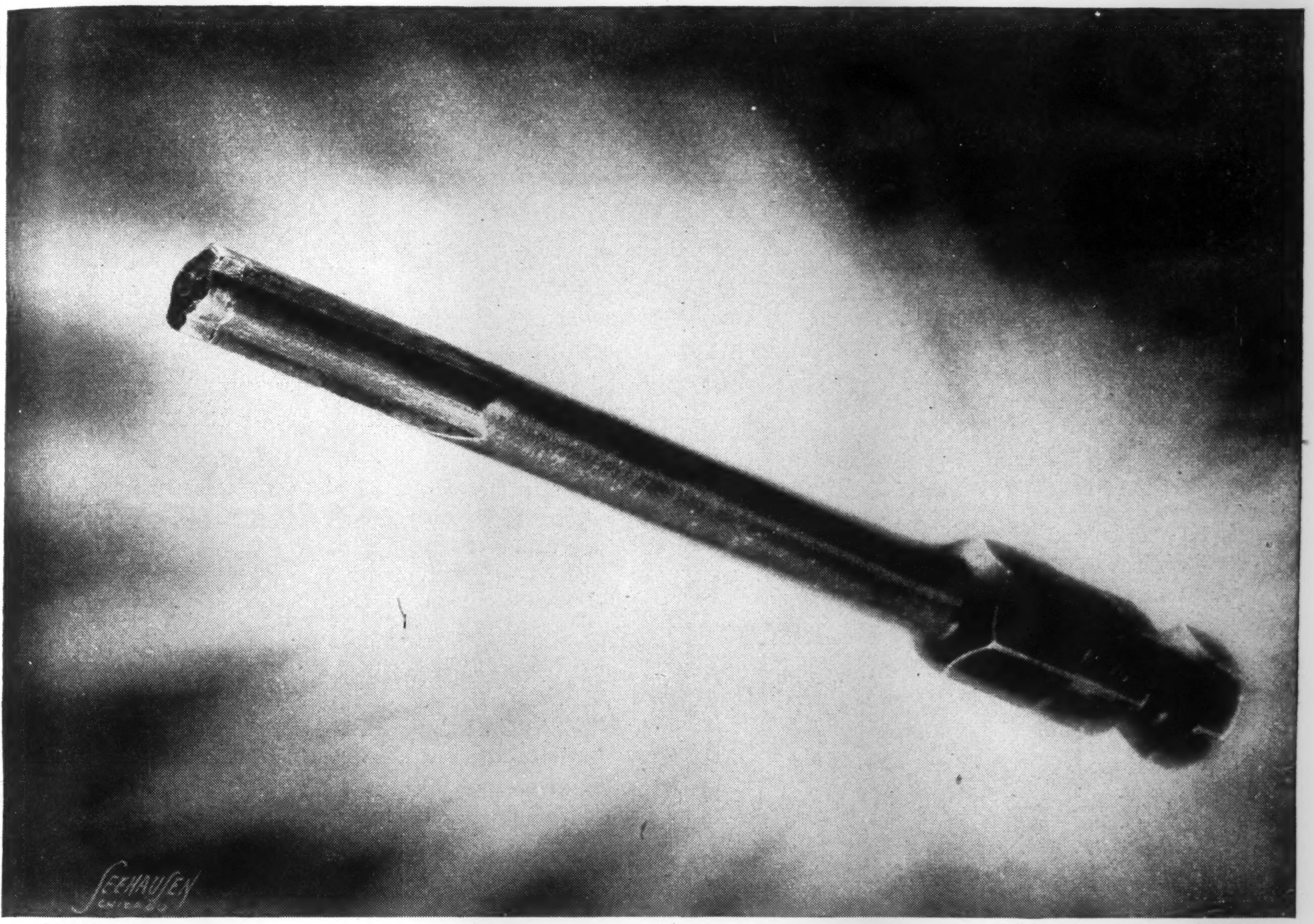
Protective Coating

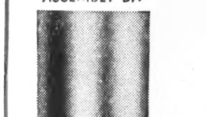
NEW SERIES of protective coatings have been announced by Watson-Standard Co., Pittsburgh 12. Known as Rx Aluminum System, the coating is said to be an ideal alternate for white base and finish coatings. These new finishes incorporate the latest war-proved technical advances and are said to be adaptable to various baking cycles. They make possible smoother base coatings and bright product finishes having eye appeal and durability. The aluminum system should be of interest to container manufacturers and metal fabricators, for it provides tough, brilliant coatings.

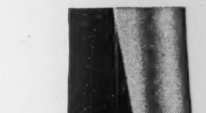
Marine Turbo-Generators

CLOSE-COUPLED, geared turbine-generators designed especially for compactness, power, and economy in marine auxiliary electrical power systems have been added to the line of General Electric marine equipment. The new turbine generators are available in 40, 50, and 60 kw sets condensing and noncondensing with inlet steam pressures up to 250 pounds and exhaust pressures up to 50 pounds. Complying with the American Bureau of Shipping, US Coast Guard Merchant Vessel Inspection, and AIEE Merchant Marine Section standards, the units are close-coupled for compactness and may be installed in a limited space. Generators are designed with features to meet the requirements of shipboard use. The enclosure is dripproof with ventilating openings screened and large cover plates easily removable for commutator inspection. Brush-holder hardware is made of corrosion-resistant material. Reduction-gear lubrication is maintained by a self-contained oiling system also furnishing oil to the governing system. Geared generators are assembled on a steel base to simplify installation, and the turbine is securely attached to the case.









This Bit
DROVE 214,000 SCREWS
IN CONTINUOUS OPERATION

This amazing record of durability was rolled up on an assembly line of the largest automobile corporation in the world.

It is a stock bit, taken out of production shipment and was used in a power driver on $\frac{5}{16}$″-24x$\frac{7}{8}$″ flat CLUTCH HEAD door hinge screws . . . an operation calling for unusually high torque driving.

It is important to note that this bit served continuously on the assembly line . . . *that there was no interruption for reconditioning* during this 214,000 driving spell.

Moreover, this bit can be *repeatedly restored to its original efficiency* by a simple application of the end surface to a grinding wheel.

Package assortment of CLUTCH HEAD Screws and sample Type "A" Bit sent on request

Tool economy is only one of the many exclusive advantages offered by CLUTCH HEAD for faster, safer, and lower-cost assembly operation. Investigate them.

CLUTCH HEAD
-SCREWS-

Check the perfect operation of this screw with an ordinary type screwdriver or any flat blade, reasonably accurate in width. Thickness of the blade is secondary.

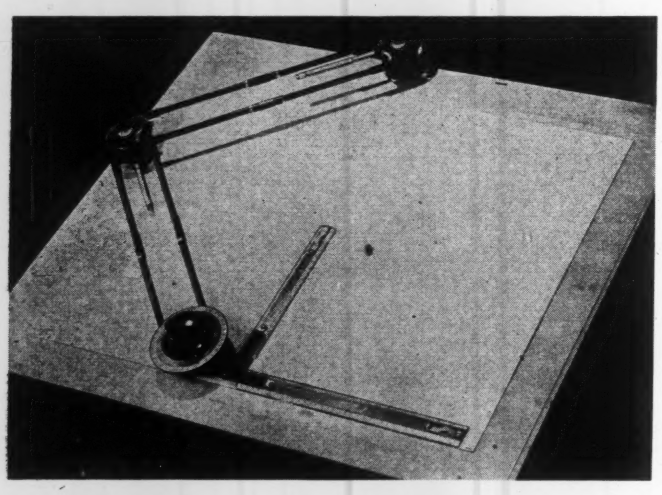
UNITED SCREW AND BOLT CORPORATION

CLEVELAND 2 CHICAGO 8 NEW YORK 7

engineering dept equipment

Drafting Machine

NEW DRAFTING machine featuring ease of operation, precision accuracy, and versatility has recently been announced by the Universal Drafting Machine Co., Payne and E. 31st St., Cleveland. Operating controls are placed at the fingertips of the left hand and are grouped within a 2 inch radius, simplifying operation. The new machine known as the Boardmaster is adaptable to all types of drawing tables whether horizontal, sloping or vertical by the addition of stabilizers or counterpoising weights. Counterbalancing at any angle is said to be frictionless. Additional new features of the machine are synthetic sapphire glides, increased sturdiness in arm and protractor, diamond turned pulleys, spot-color controls and glareless aluminum matte finish. The machine is said to be operable by feel alone—without visual reference.



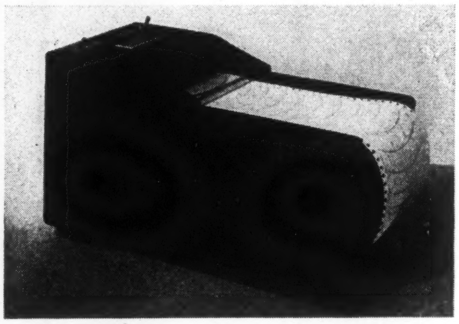
Watt-Var Autoswitch

WATTS
VARS
GENERAL ELECTRIC
WATT-VAR AUTO SWITCH

ANNOUNCEMENT of a new autoswitch permitting recording of watts and vars on a single instrument has been made by the Meter and Instrument Division of the General Electric Co., Schenectady. The instrument gives direct, accurate information of the amount of corrective kva needed, and at the same time records the power component and kilowatts. Both records are on the same chart assuring perfect synchronism of records. The autoswitch consists of two autotransformers, a time switch, two double-pole double-throw relays, fuses, indicator lamps and connectors for cables. The switching interval is one complete cycle per minute. Set at the factory for 35 per cent on vars and 65 per cent on watts the time switch may be adjusted from 50 per cent to nearly 100 per cent on watts. The instrument is available in portable and semiflush switchboard mounting, and dimensions of the portable unit are 5⅝ in. wide, 8 in. high, 14 in. long. Weight is 14 lb. Finish of the instruments is black lacquer matching type CD instruments.

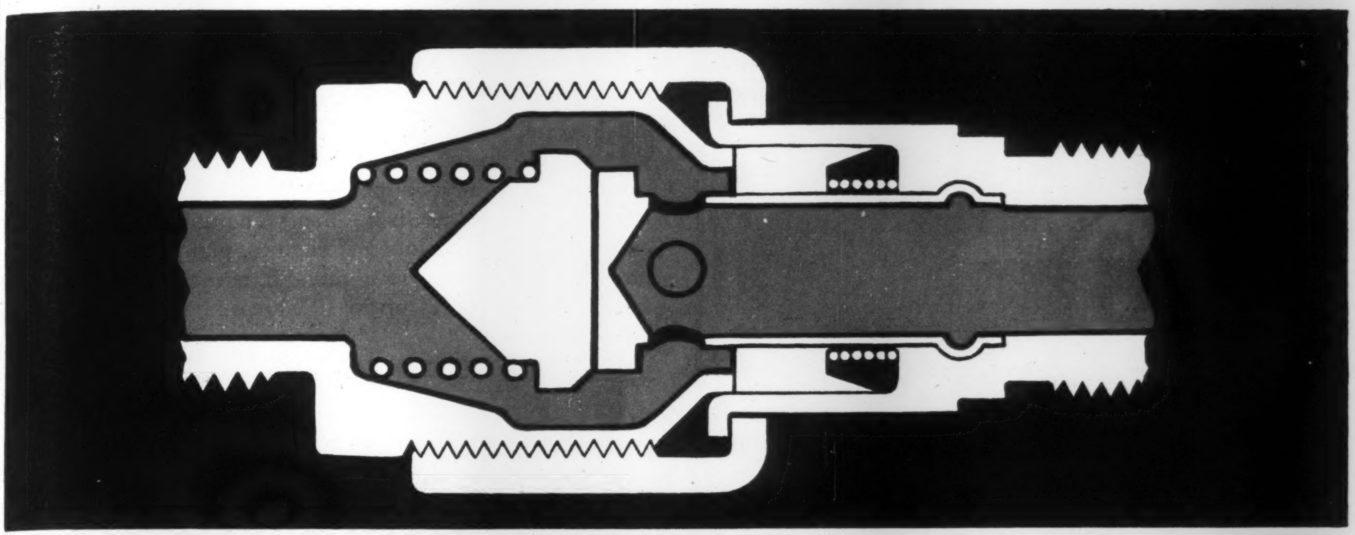
Profilometer Reading Recorder

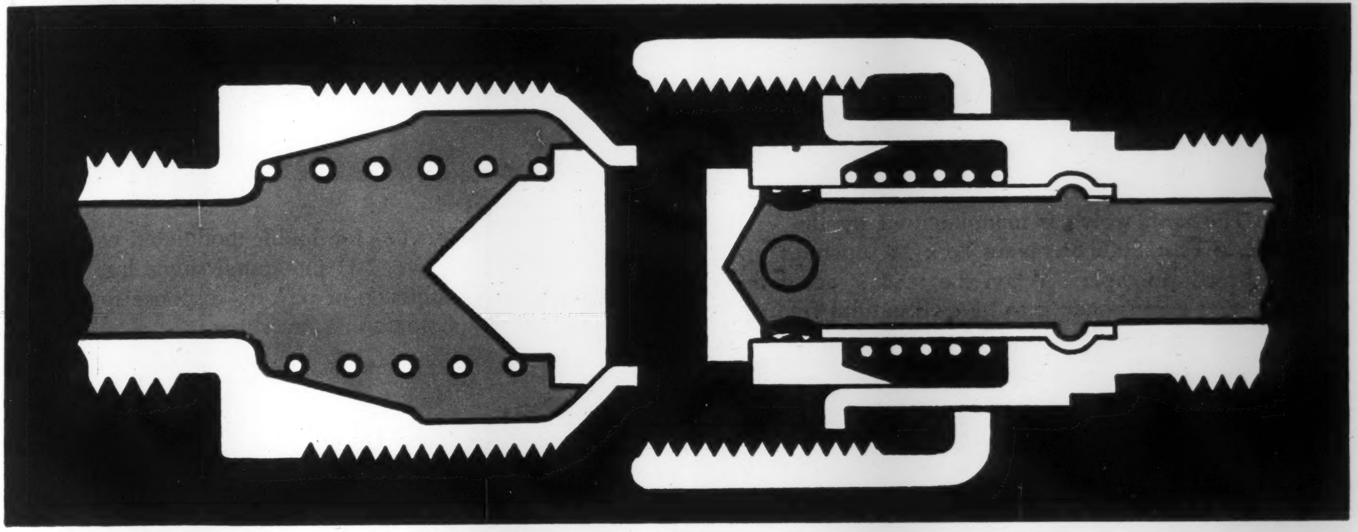
PROFILOMETER reading recorder has been developed to provide a record of the surface roughness measurement of a given part. The unit operates as an attachment to profilometers manufactured by the Physicists Research Co., Dept. 4, 321 South Main St., Ann Arbor, Mich. Charts are read in microinches and are said to be useful in obtaining more detailed information on surface roughness, such as the location of rougher or smoother areas. It is also useful in supplying a record of surface finish on parts. The recorder attaches at the meter jack provided on profilometers and no adaptations of existing profilometer equipment are necessary.



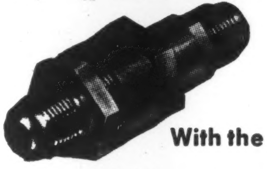
Continuous Printer

IMPROVED B-2 and B-3 table-type continuous printers are announced by Peck & Harvey, 5736 N. Western Ave., Chicago 45. They expose direct process black and white prints, blue prints, and ammonia-type prints from tracings, charts, etc., and produce clear, sharp, true-to-scale prints up to 44 inches wide in a continuous operation. Speed may be varied from 6 to 42 inches per minute. Light is provided from Cooper-Hewitt mercury-vapor lamps and Alzak aluminum reflectors. Constant-current rheostat gives finger-tip speed control. Model B-2 printer is





AEROQUIP Self-Sealing Couplings*



eliminates the use of 2 Valves

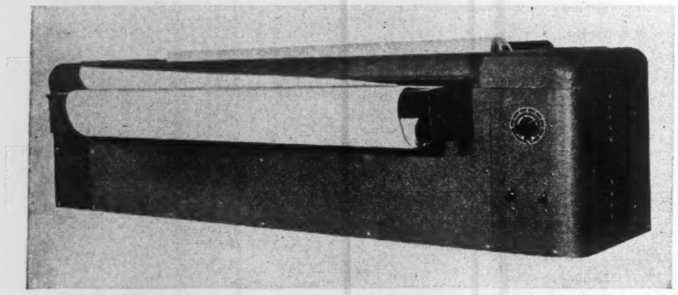
With the Aeroquip Self-Sealing Couplings, fluid carrying lines may be instantly disconnected without leakage. Upon separation each half of the coupling automatically closes the line or tube to which it is connected and positively retains the fluid carried therein. No leakage or loss of fluid occurs and no air is allowed to enter the system on reconnection. Suitable for hydraulic and refrigeration systems as well as any lines carrying oils, fuels, coolants, or refrigeration gases.

AEROQUIP FIRSTS

- **Detachable Hose Fittings**
- **Hydrofuse**
- **X-Washers**
- *** Another Aeroquip First**

AEROQUIP CORPORATION
JACKSON, MICHIGAN

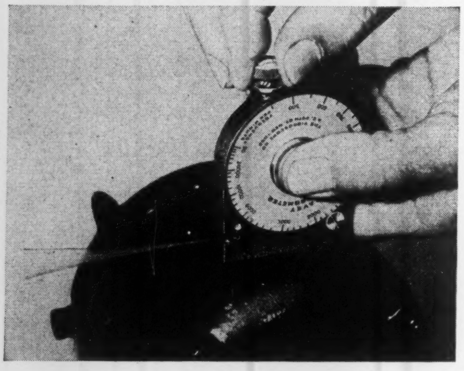
327 M & M BUILDING, HOUSTON 2 • • • 1709 W. 8TH ST., LOS ANGELES 14 • • • 803 PENCE BUILDING, MINNEAPOLIS 3



equipped with two mercury tubes and consumes 900 watts. Unit B-3 is equipped with three mercury tubes and consumes 1250 watts. Both machines operate on 110 volts 60 cycles ac and are also available in other ac and dc voltages and frequencies.

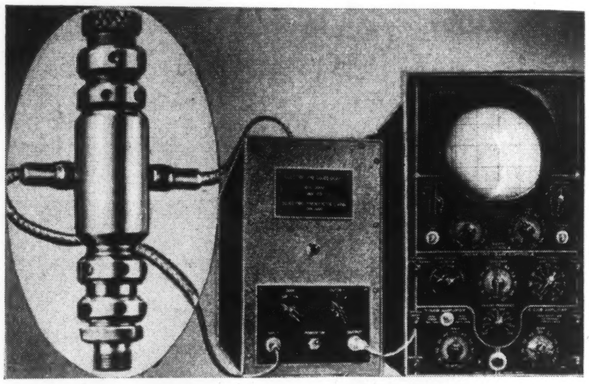
Vibration Measuring Device

VEST POCKET Vibrometer weighing less than 5 ounces will measure vibration from 450 to 50,000 cycles-per-minute. The unit, which is manufactured by the Vibroscope Co., 6 East 39th St., New York 16, operates upon the tuned-reed principle. When the reed is acted upon by a vibration corresponding to its own natural frequency it develops a vibration amplitude many times in excess of the exciting vibration. The instrument is applied by holding it in contact with the vibrating body and turning the knurled knob to feed out a steel reed from the instrument. The unknown vibration is identified when the reed vibration builds up to its maximum amplitude. Vibration frequency in cycles-per-minute is read directly from a graduated dial. In cases where there are several disturbing frequencies the vibrations are of a complex wave form, the instrument will pick out each of the frequencies separately and evaluate its comparative amplitude.



Pressure-Time Indicator

INSTRUMENT for studying cyclic pressure-time relationship which incorporates an oscilloscope has recently been announced by Electro Products Laboratories, 349 W. Randolph St., Chicago 6. A pick-up in the instrument unbalances an electronic circuit connected to a cathode ray oscilloscope. When the oscillograph circuit switch is adjusted to the speed of the mechanism under test, the true-pressure time curve appears on the scope as a band of light—an area rather than a line. The unit is recommended for studies of all types of engines, pumps, compressors, air and liquid pipe lines, etc. It covers all mechanical speeds and pressures up to 10,000 psi. Three output selections are possible: (1) for double modulated wave; (2) for indicator card wave; (3) integrated single line providing means for transmission of pick-up response to a string oscillograph for photographic recording.



Breathers

(*Concluded from Page* 77)

tween the orifices even towards the end of the sun's action, i.e., when $T_L > T_B$ is a question of probability and an impossibility near equilibrium.

While the breather is thus demonstrated to be inefficient, several possibilities seem promising. Tests were run comparing the relative efficiency of containers prepared in three different manners. The first was sealed in a manner common to machines in that no sealing compounds were used, and metal to metal seals existed. In the second, breathers were installed in the prescribed manner. The third container was similar to the first but with silica gel inside. The moisture eliminating effectiveness of the three methods was determined by measuring the change in dielectric of a plastic terminal strip placed inside the container. The results are indicated in *Fig.* 4. Confirming the foregoing analysis, breathers proved an aggravating device. Silica gel provided a relatively good, dry enclosure throughout the period of the test.

Since condensation in atmospheres of relative humidity less than 100 per cent is due to night radiation from solid parts of the housing exceeding that from surrounding air, containers similar to thermos bottles—having bright walls—seem advisable. In contradistinction, however, the space between the walls need not be evacuated, since convection due to air motion causes no difficulties. Porous sections may also prove helpful. If the holes are smaller than the mean free path, flow from the cooler to hotter portions will occur thus preventing the machine from losing heat too rapidly through any one of the several heat processes.

J-M Moulded Packing Cups

custom-made to fit right...seal tight

Tailored to meet any desired combination of service conditions, J-M Moulded Packing Cups offer designers a ready answer to packing problems.

Made of asbestos, duck or other fabrics, and impregnated with heat- or oil-resisting compounds selected for the particular conditions to be encountered, they retain their shape during long service . . . provide a positive seal with minimum friction under high pressure and temperature conditions. Available in a wide variety of shapes and sizes for use on all types of slow-moving pistons and rams operating against air, water, steam, oil, etc.

Tell us your requirements—we'll tailor the cup to fit your needs! Write today for the brochure, "J-M Packings for the Product Designer." Johns-Manville, Box 290, New York 16, N. Y.

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JM
PRODUCTS

Johns-Manville
PACKING & GASKETS

ASSETS to a BOOKCASE

Plastics Encyclopaedia, 1946

Published by Plastics Catalog Corp., New York; 1390 pages, 8½ x 7¼ in., leather bound, available through Machine Design, $6.00 *postpaid.*

This the latest edition of the Plastics Catalog endeavors to present a comprehensive treatment of the plastics field. As previously, such aspects as plastics properties, machining and mold-making techniques, and applications have been carefully covered. In each instance, however, the data have been brought up to date and many new materials, developed since the last edition was published, are in evidence. Information not commonly available includes a directory section listing manufacturers, a bibliography of plastics articles, and nine large charts giving particular properties of the plastics.

□ □ □

Heating, Ventilating and Air Conditioning Guide

Published by the American Society of Heating and Ventilating Engineers, 51 *Madison Ave., New York* 10: 1279 *pages,* 6 *by* 9 *inches, cloth bound; available through* Machine Design, $6.00 *postpaid.*

This the 1946 edition is the 24th of an annual series dealing with air conditioning systems. As is evidenced by the size of the book, the editors have made a consciencious attempt to cover the field in detail. Typical subjects discussed are: Thermodynamics, fluid flow, heat transfer, fuels and combustion piping and fittings, welding, insulation, panel heating and radiant heating, fans, refrigeration, duct design, drying systems, transportation air conditioning, and codes and standards. New chapters have been added on fluid flow and costs. Additional data has been provided concerning test codes and the properties of moist air and water. Several new charts have been added which include an enlarged Mollier diagram, a new air-friction chart, a chart concerning flow of water in pipes.

□ □ □

Induction Heating

By Osborn, Brace, Johnson, Cable and Eagan, published by the American Society for Metals, Cleveland; 172 *pages,* 6 *by* 9 *inches, cloth bound; available through* Machine Design, $3.00 *postpaid.*

Many of the important aspects of induction heating are treated in this noteworthy symposium by men acknowledged to be outstanding in their field. Covered are the theory and the principles of the method as well as its applications in comparison with other methods. Although remarkable things can be done with this process, the proper design of parts for induction hardening should be considered, and a proper hardening selection should be made. An example of this is the hardening of flat surfaces where flame hardening by reason of the simplicity of equipment necessary is the method of choice. In general, induction heating tends to overheat corners with the result that cracks are likely to occur. Individual handling is required. For the engineer concerned with the design of parts requiring heat treatment of whatever form this book is recommendued. It will clarify in his mind the design problems associated with induction heating, and the advantages to be realized therefrom.

□ □ □

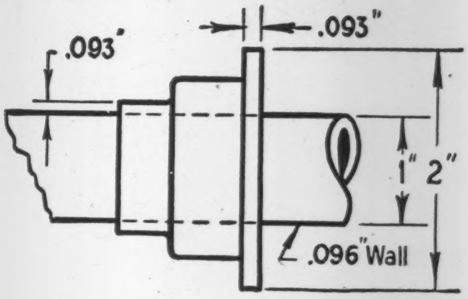
Thermodynamic Properties of Air

By Joseph H. Keenan and Joseph Kaye, Massachusetts Institute of Technology; published by John Wiley & Sons Inc., New York; 73 *pages,* 7½ *x* 10 *in., clothbound; available through* Machine Design $2.25 *postpaid.*

Conveniently appearing at a time when air processes such as are concerned with the gas turbine are of great concern, this tabulation serves as a valuable time-saver to the designer. Being more nearly a perfect gas at working temperature than steam, air has a simpler equation of state, and the relationship $PV = RT$ is deemed sufficiently accurate. For this reason, the table of properties for air are simpler than the corresponding tables for vapors, and a more detailed table is possible for given space. In addition to the tables of thermodynamic properties, values are given for viscosity, thermoconductivity, and Prandtl number. Placing all their tables at the front of book, the authors have devoted 15 pages at the end to the development of equations, discussion of their methods, and typical examples. Conditions for the gas turbine, Otto engine, and the Diesel engine are well covered.

Now available are supplements to the 1945 ASTM book of standards reviewed in the August, 1945, issue. Also including tentative standards, the supplement is printed in a style similar to the earlier edition, being in three volumes. Part I, concerning metals, contains 394 pages. Part II concerning nonmetallic construction material has 227 pages and Part III concerning general nonmetallic materials has 503 pages. An elaborate system of stickers, when affixed to appropriate pages of the 1944 book of standards, calls attention to standards that have been superseded in this supplement. The clothbound supplements are available postpaid through Machine Design at $4.00 per part. Leather bindings are available for $2.00 additional.

How "Job-Rating" can improve YOUR designs!



TYPICAL JOB

Assemble and join thin mild steel stampings and tube to resist torque, compression and shear.
No distortion or surface marking permissible on tube.
Total units required—50,000
Production required—1200 per 8-hr. day

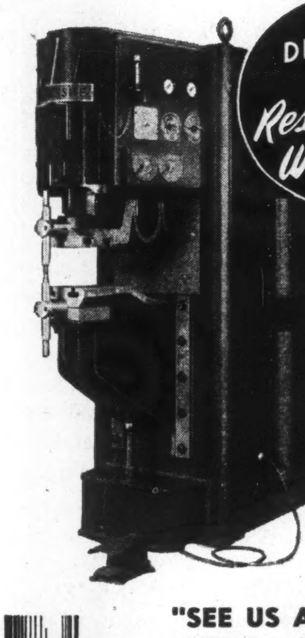
JOB-RATING

METHOD	BEST OUTPUT	MAX. STRENGTH	MIN. FINISHING REQUIRED	LOWEST COST PER PIECE
SPOT WELD	1	1	1	1
ARC WELD		2		2
TORCH WELD				
SOLDER (TORCH)			2	
FURNACE BRAZING	2			

List possible joining methods and controlling factors, as above.
Rate the methods 1, 2, for each design factor.
Select the best method. Check your design with this method in mind.

ANALYSIS

Watch resistance welding come up No. 1 on every count! This example shows over 70% savings for spot welding over the second best method, in labor costs alone. In addition, strength is "tops". There is no distortion. Output is far ahead of other methods. Only design factor involved is to make sure there is room on the sleeve for the spot welds. Your analysis may also show similar advantages for resistance welding in a vast majority of assembly problems. 'Progressive' machines, such as the spot welder at left, prove that it pays to weld on job after job.



DESIGN for *Resistance Welding*

"SEE US AT THE METALS SHOW" BOOTH J-220

IT PAYS TO WELD

For news of the latest developments in resistance welding equipment and methods, influencing product design, ask to be put on the mailing list for the Progressive "WELDING PICTORIAL".

MEMBER RWMA RESISTANCE WELDER MANUFACTURERS ASSOCIATION

PROGRESSIVE Welder Co. 3050 E. OUTER DRIVE • DETROIT 12
RESISTANCE WELDING EQUIPMENT

Roy Dally

Harry L. Keller

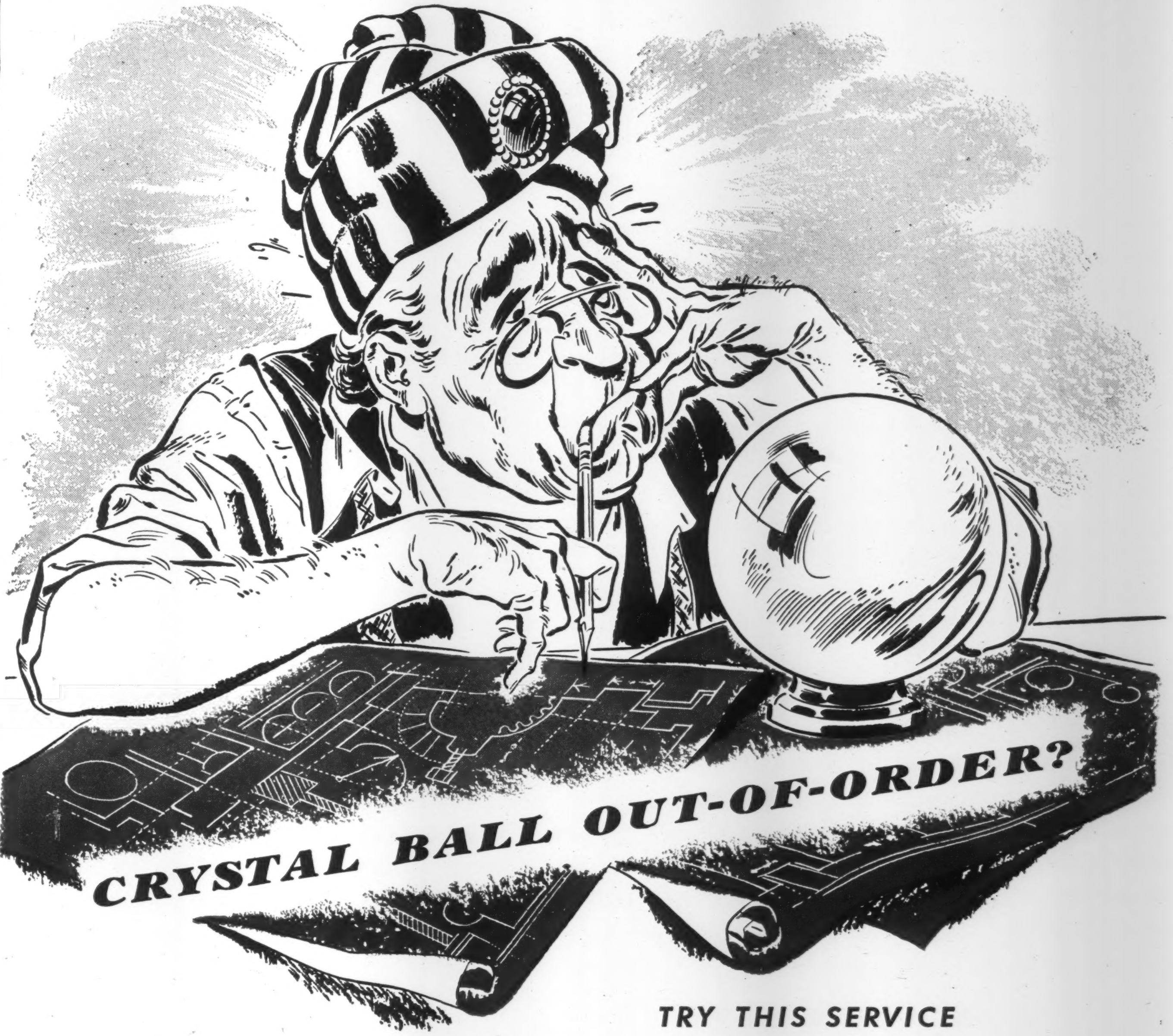
Jerome C. Hunsaker

MEN... of... machines

ROY DALLY, an authority on phonograph reproduction, has been appointed chief engineer in charge of phonograph pick-up design for Electrovox Co. Mr. Dally had formerly acted as consultant to the company on design research. He has worked with leading radio-phonograph manufacturers in attaining greater fidelity in sound reproduction and increasing the playing life of record disks. Mr. Dally will be available for consultation in radio and electronics, and will continue to work closely with the manufacturers in the radio industry.

HARRY L. KELLER, formerly in charge of engineering standards at Buick Motors Corp., has joined Ohio Crankshaft Co. as head of its new Tocco commercial engineering department. Mr. Keller started his career as a checker in the drafting room in 1921, and progressively was motor engineer, production contact, cost analyst, and production engineer in charge of engineering standards at Buick. During the war he served as special contact man between engineering production at Buick Melrose Park, Ill., plant and Pratt & Whitney in Hartford, Conn. Mr. Keller was also chairman of the General Motors Engineering Standards Council, a group responsible to the organization's technical committee for all engineering standards relating to automotive production. He contributed largely to the reorganization of this council in 1943. The council has initiated improvements in screw-threads, spline and lubrication fitting design, promoting them through various committees of the American Standards Association. Mr. Keller is a member of the Society of Automotive Engineers as well as the American Society of Metals, and is active in the work of the American Standards Association, being chairman of the national committee on drafting room practice and a member of the committee on screw thread standards.

JEROME C. HUNSAKER, head of the departments of mechanical engineering and aeronautical engineering at Massachusetts Institute of Technology, has been elected a director of The Goodyear Tire & Rubber Co. Dr. Hunsaker is also chairman of the National Advisory Committee for Aeronautics, treasurer of the National Academy of Sciences, and holds directorships in The Sperry Corp., Shell Union Oil Co. and McGraw-Hill Publishing Co. From 1928-1933, during the building of the airships Akron and


CRYSTAL BALL OUT-OF-ORDER?

TRY THIS SERVICE

Unforseen conditions and difficulties encountered in designing a new machine or process possibly can be eliminated through the use of hydraulics. And there's where we can give you *quick* service.

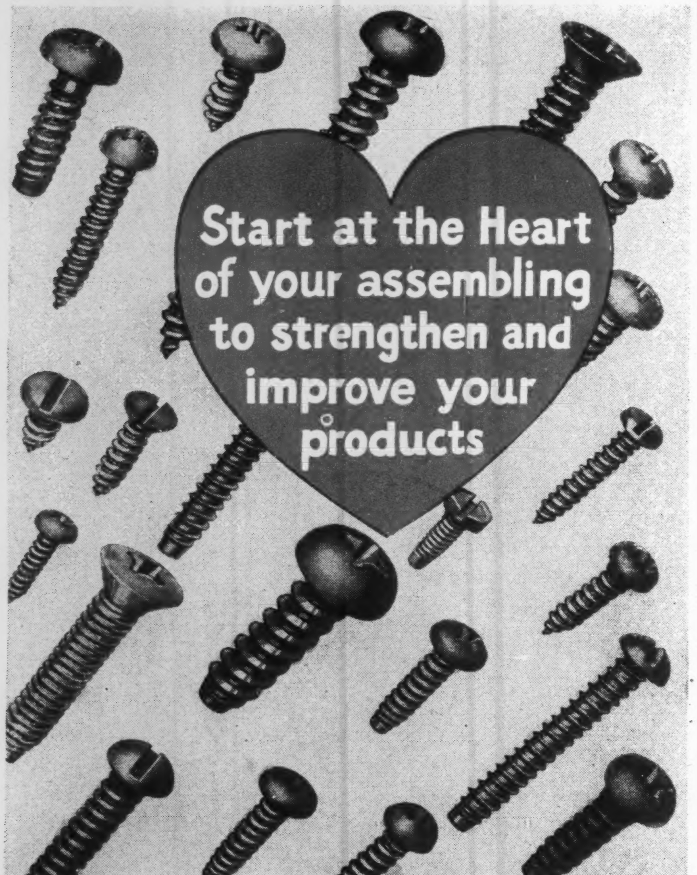
We build the Hele-Shaw Fluid Power pumps, also design a complete Fluid Power System, and furnish all component equipment. Our engineers talk your language, are not high pressure, and are always ready to be of service.

Take us up on this offer. You gain by it. A discussion costs nothing, creates no obligation, gives you the advantage of 30 years of Fluid Power experience. Call our representative today (see your classified directory under Hele-Shaw) or write us for details.

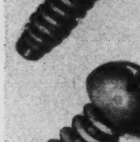
THE HELE-SHAW
Fluid Power PUMPS
FLUID POWER Systems

OTHER Æ PRODUCTS:
Æ-TAYLOR AND PERFECT SPREAD STOKERS,
MARINE DECK AUXILIARIES, LO-HED HOISTS

Æ **AMERICAN ENGINEERING COMPANY**
2502 ARAMINGO AVENUE, PHILADELPHIA 25, PA.


Start at the Heart of your assembling to strengthen and improve your products

Rugged, precision-made HOLTITE "Thread-Forming" screws insure enduring, trouble-free performance. Drive'em and forget'em! Engineered from raw material to final finishing to provide smooth, speedy application in any material. Save tapping costs . . . eliminate waste and spoilage — specify HOLTITE. Our laboratory and engineering facilities are always available for the solution of your fastening problems.



HOLTITE-Phillips Recessed Head Screws permit safe power driving on jobs previously limited to slow hand driving. Cut fastening time in half . . . strengthen assembly . . . add to the appearance of your product.

CONTINENTAL SCREW CO.
Established 1904
New Bedford, Mass., U.S.A.

Macon, he was vice president of The Goodyear-Zeppelin Corp. In 1933 he was awarded the Guggenheim medal for the introduction of the application of aerodynamic research in the design of American aircraft by first translating and making available Eiffel's work and later by building the first wind tunnel at M.I.T. Born in Creston, Ia., in 1886, Dr. Hunsaker was graduated from the United States Naval academy in 1908. The degrees of master of science and doctor of engineering were conferred upon him by M.I.T., where from 1914 to 1916 he was instructor in aeronautical engineering and a research worker in aerodynamics. Dr. Hunsaker is also credited with having developed the first modern nonrigid airship produced in the United States. He is an honorary fellow of the Institute of Aeronautical Sciences and of the Royal Aeronautical Society of Great Britain; honorary member of The American Society of Mechanical Engineers and of the British Institution of Mechanical Engineers.

William Harrigan, who has been with the Texas Co. for twenty years, has been appointed chief engineer of the automotive division. Mr. Harrigan has for several years been a consulting technologist.

◆

R. Dixon Speas, formerly assistant to the vice president of engineering, American Airlines Inc., has been appointed director of engineering and maintenance of the company's Contract Air Cargo Division, with headquarters at St. Joseph, Mo.

◆

Seneca G. Coon Jr. has become associated with the Research Division of Aerojet Engineering Corp., Azusa, Calif., where he will be engaged in the design and development of rockets and jet propulsion motors. Mr. Coon previously had been a designer of gasoline and diesel engines with Mack Mfg. Corp., Plainfield, N. J. and, prior to his new appointment, had been connected with Hawkins Engineering Laboratories, Fresno, Calif.

◆

Richard A. Booker Jr. has joined Marhoefer Engine Co., Camden, N. J., as designer. He had formerly been group supervisor in charge of rotor blade and attachments design, Kellett Aircraft Corp., Upper Darby, Pa.

◆

John Markell Jr. is now a development engineer with the Aviation Gas Turbine Division of Westinghouse Electric Corp., Lester, Pa.

◆

Edward N. Cole has been appointed chief engineer of the Cadillac Motor Car Division of General Motors Corp. Following his graduation from school, Mr. Cole joined the corporation and rose from laboratory assistant to designer, engine engineer, chief design engineer, and then assistant chief engineer late in 1944.

◆

R. C. Stolte has been transferred from his position as head of Canadian operations for General Motors Corp. to the post of engine development engineer, Chevrolet Light Car Division of the corporation.

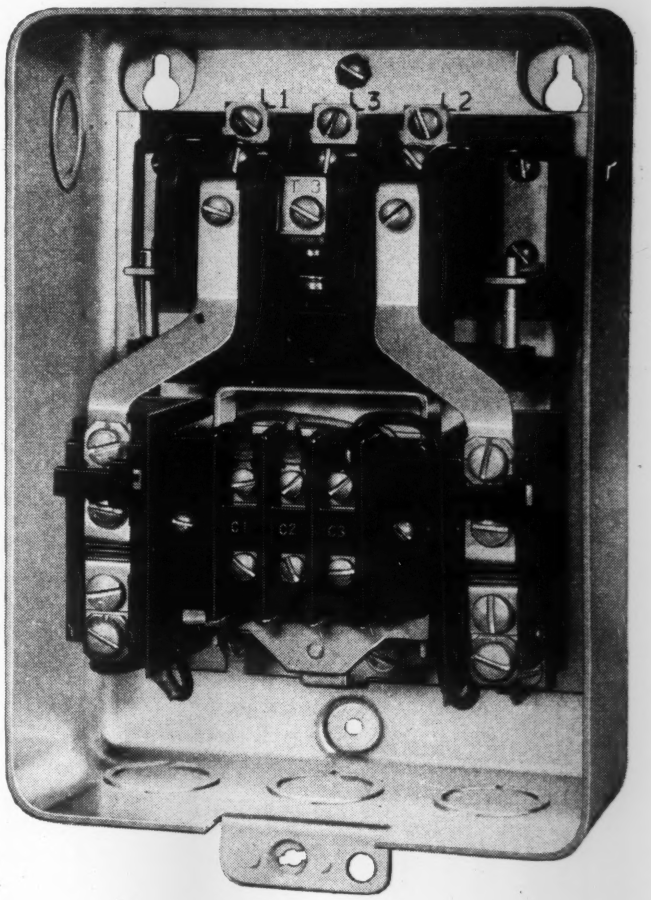
◆

Don B. Webster has resigned as head of the mechanical laboratory, Aircraft Engine Division, Packard Motor Car Co., Toledo, to join the automotive research department of Ford Motor Co., Dearborn, Mich.

YOU'VE SEEN THIS ANNOUNCEMENT OF THE MASTER MOTOR STARTER

MASTER
Proudly we present
a NEW motor starter
THE MASTER ELECTRIC CO.
MASTER
DAYTON 1, OHIO

Now The Lid's Off



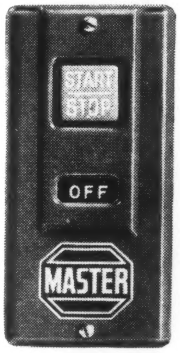
Master Motor Starters have a great many distinguishing features which are quite evident when you remove the cover . . . so here is *an inside view* showing a few of the basic design innovations. (Across-the-line AC magnetic starter, Form B-1, requiring remote control station.)

Clean Design—From a glance at this interior you will appreciate the orderliness of layout and compactness of the entire assembly.

Simple Construction—All terminals and mounting screws easily accessible from the front. Heaters for overload relays also readily accessible.

Rugged Assembly—Exemplified by sturdy formed straps rather than flexible wire as jumpers from overload relays to contact terminals for added rigidity.

Ease of Installation and Maintenance
No trick arrangements to puzzle electricians. Starters for remote control have barrier type terminal boards with control connections plainly marked and with complete wiring instructions inside cover. All contacts are easily replaceable without removing mechanism from the case.



PUSH-BUTTON CONTROL

Master Single-Button Type—An exclusive Master feature is the single push-button which is used for both starting and stopping, and which has a signal flag to indicate whether the motor is "on" or "off." The illustration shows the remote control station with single push-button and indicator flag. The start-stop single button is also used where control integral with the starter is desired.

Conventional Two-Button Type—For applications where multiple remote control of a single starter is desired, the conventional two-button control can be furnished. *Write for Master Bulletin 200.*

THE MASTER ELECTRIC CO. MASTER **DAYTON 1, OHIO**

BUSINESS AND SALES BRIEFS

Now under construction by General Electric Co. is a new factory at Waterford, N. Y., which will result in reduced costs and a consequent broadening of uses for silicone products. Production is expected to begin sometime after January 1.

◆

Babcock & Wilcox Tube Co. has appointed Joseph T. Ryerson & Son Inc. as distributor of its electric resistance-welded boiler tubes. Ryerson plants are located in Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Pittsburgh, Buffalo, Philadelphia, New York and Boston.

◆

Election of R. F. Doyle as president has been announced by Alliance Mfg. Co. of Alliance, O., a large producer of special type fractional horsepower electric motors. Prior to his election Mr. Doyle served as general manager and treasurer.

◆

Associated with the company since 1934 as sales engineer, Carl O. Ericke has been appointed district manager of the Detroit territory of the Carpenter Steel Co., Reading, Pa.

◆

Aluminum Co. of America is planning to construct a plant in Des Plaines, Ill., for the manufacture of aluminum die castings. The new plant will be built on a thirty-five acre site at Wolf and Algonquin Roads, including manufacturing, service and office buildings.

◆

To serve as its representative in the New York City territory, Valve & Primer Corp. of Chicago has appointed Mr. A. H. E. Berchem, Berchem Co., 50 Church St., New York 7. Mr. Berchem will help to solve air-relief and pump-priming problems.

◆

With offices in Atlanta, C. C. Smith has been named special headquarters electronics sales representative in the southeastern district for Westinghouse Electric Corp. His territory will include all of North and South Carolina, Georgia, Florida, Alabama, and portions of Tennessee, Mississippi and Louisiana.

◆

Bailey Meter Co., Cleveland, has granted an exclusive license to Monarch Machine Tool Co., Sidney, O., to build and market the pneumatic-hydraulic contour turning mechanism introduced by the former concern two years ago. Representing Monarch in the transaction were Woodling & Krost, Cleveland patent attorneys.

◆

Opening of a new district office at 424 Boulevard Bldg., Detroit 2, has been announced by The Electric Products Co., Cleveland 12. With E. G. Schroeder in charge as district manager, the new office will handle all sales and service negotiations in Michigan, northwestern Ohio and northwestern Indiana. Formerly Mr. Schroeder was associated with the New York State Electric & Gas Corp. and General Electric Co.

Made for you

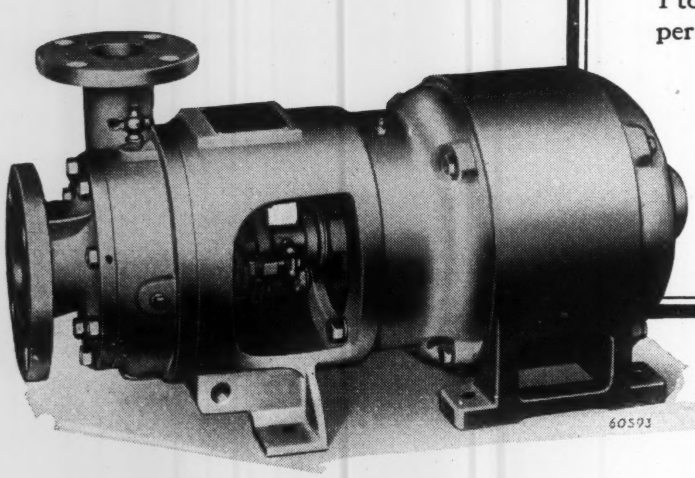
The MOTORPUMP

In a sense the Ingersoll-Rand Motorpump is custom made because the range of sizes enables you to pick the correct size pump to fit your particular application. Heavy-duty units are available in 1½, 2, 3, 4 and 5-inch discharge sizes with motors from 1 to 40 horsepower, handling from 10 to 1800 gallons per minute against heads up to 500 feet. Standard units with most of the features of heavy-duty units are also available in ¾, 1, 1½ and 2-inch discharge sizes.

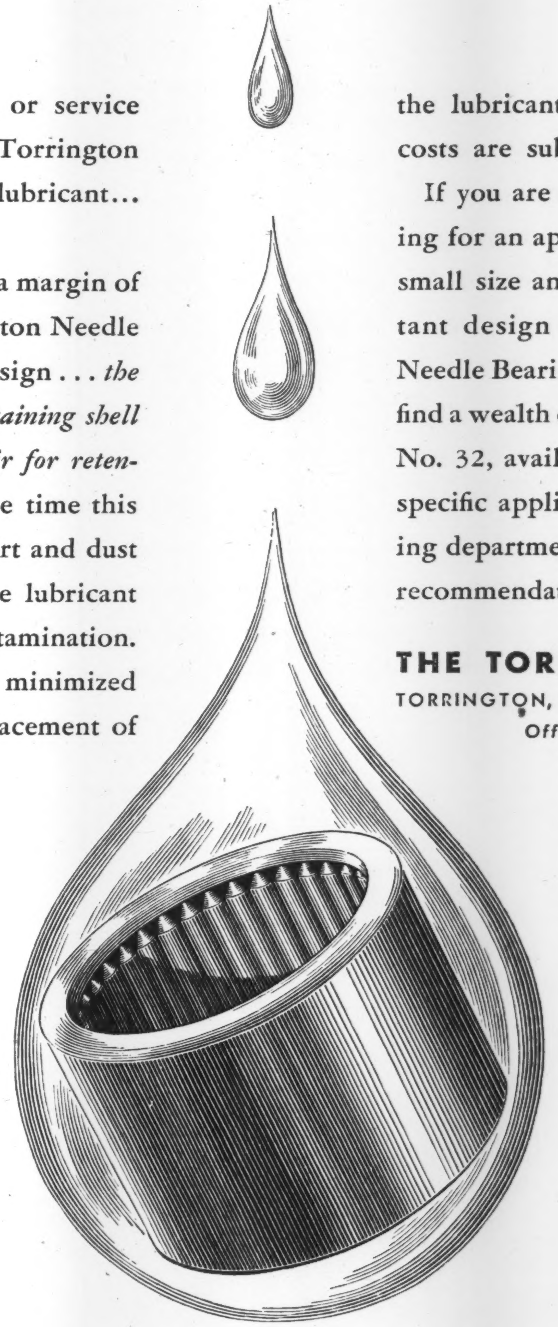
Call your nearest I-R branch office or your local I-R distributor for complete details.

9-669

Ingersoll-Rand
11 Broadway, New York 4, N. Y.



They make the lubricant last longer...



Yes, whatever the load, speed or service requirements of the installation, Torrington Needle Bearings help conserve lubricant... prolong its effective life.

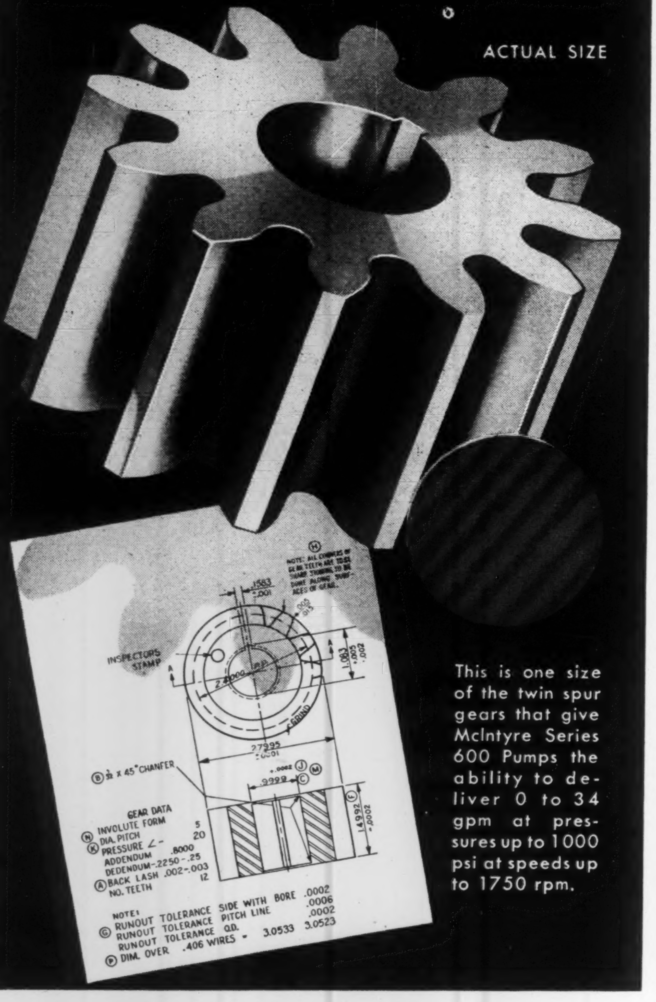
That's because there is an extra margin of lubrication efficiency in Torrington Needle Bearings due to their basic design ... *the turned-in lips of the hardened retaining shell which provide a natural reservoir for retention of the lubricant.* At the same time this same feature helps to exclude dirt and dust from vital bearing surfaces. The lubricant is kept clean and free from contamination. Consequently, bearing wear is minimized ...less frequent renewal or replacement of the lubricant is required ... maintenance costs are substantially reduced.

If you are seeking an anti-friction bearing for an application where high capacity, small size and economical cost are important design considerations, Torrington Needle Bearings may be *your* answer! You'll find a wealth of pertinent data in our Catalog No. 32, available on request. If you have a specific application in mind, our engineering department will gladly give you specific recommendations.

THE TORRINGTON COMPANY
TORRINGTON, CONN. • SOUTH BEND 21, IND.
Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

EFFICIENCY GOES UP WHEN
Precision Gears
HAVE TOLERANCES LIKE THESE



This is one size of the twin spur gears that give McIntyre Series 600 Pumps the ability to deliver 0 to 34 gpm at pressures up to 1000 psi at speeds up to 1750 rpm.

YET McINTYRE GEARS COST YOU NO MORE THAN ORDINARY ONES. Consider how much you can increase the efficiency of your geared mechanisms when your spur gears are mass-produced by men and machines *capable of holding vital dimensions to tolerances of tenths and split-tenths . . . surfaces flat to one light band.* That's what The McIntyre Co. offers you at little or no increase in cost.

Routine McIntyre shop methods produced the illustrated gear with sides lapped within .00005″ of parallelism . . . O.D. ± .0001″ . . . I.D. + .0002″ . . . pitch diameter eccentricity .0003″.

You can get the same or closer tolerances in spur gears up to 10″ O. D. in any material by specifying McIntyre Precision Gears. Submit specifications for estimates. The McIntyre Co., 300 Riverdale Ave., Newton 58, Mass.

THE McINTYRE CO.
PUMPS AND FLUID MOTORS

THE ULTIMATE IN PRECISION IDENTIFIED BY THE LIGHT BAND

Meetings and Expositions

Oct. 16-17—

Society of Automotive Engineers Inc. National transportation and maintenance meeting to be held at Hotel Knickerbocker, Chicago. John A. C. Warner, 29 West 39th St., New York 18, is secretary and general manager.

Oct. 18-20—

West Coast Electronics Manufacturers Association. Second annual electronics trade show to be held at the Elks Club, Los Angeles. D. D. Durr, The Tabery Corp., 3443 South Hill St., Los Angeles, is show director.

Oct. 23-25—

American Society of Body Engineers Inc. Technical convention to be held at Rackham Memorial Bldg., Detroit. Otto Graebner, Murray Corp., Detroit, is secretary.

Oct. 23-26—

National Tool & Die Manufacturers Association. Annual meeting to be held at Congress Hotel, Chicago. George Eaton, 1412 Union Commerce Bldg., Cleveland 14, is executive secretary.

Oct. 28-30—

American Gear Manufacturers Association. Semiannual meeting to be held at Edgewater Beach Hotel, Chicago 14. Newbold C. Goin, Empire Bldg., Pittsburgh 22, is executive secretary.

Oct. 29-Nov. 1—

Fourth All-Industry Refrigeration and Air Conditioning Exposition to be held by Refrigeration Equipment Manufacturers Association in cooperation with the Frozen Food Locker Manufacturers and Suppliers Association, in Cleveland Public Auditorium, Cleveland. Exposition headquarters are at 1107 Clark Bldg., Pittsburgh. R. Kennedy Hanson, executive secretary of the Refrigeration Equipment Manufacturers Association, is show director.

Nov. 7-8—

Society of Automotive Engineers Inc. Fuels and lubricants meeting to be held at Mayo Hotel, Tulsa, Okla. John A. C. Warner, 29 West 39th St., New York 18, is secretary and general manager.

Nov. 18-22—

National Metal Congress and Exposition to be held at Municipal Auditorium, Atlantic City, N. J., in conjunction with the annual meetings of the following societies: American Society for Metals; Iron and Steel Division and Institute of Metals Division of American Institute of Mining and Metallurgical Engineers; American Welding Society; and American Industrial Radium and X-Ray Society. Chester L. Wells, 7301 Euclid Ave., Cleveland 3, is assistant managing director of the exposition.

Dec. 2-4—

Society of Automotive Engineers Inc. Air transport engineering meeting to be held at Edgewater Beach Hotel, Chicago 14. John A. C. Warner, 29 West 39th St., New York 18, is secretary and general manager.

steady industry

Dec. 2-6—

American Society of Mechanical Engineers. Annual meeting to be held in New York City. Additional information may be obtained from headquarters of the society at 29 West 39th St., New York 18. C. E. Davies is secretary.

Dec. 2-7—

Seventeenth National Exposition of Power and Mechanical Engineering to be held at Grand Central Palace, New York. Charles F. Roth, at the same address, is manager of the exposition.

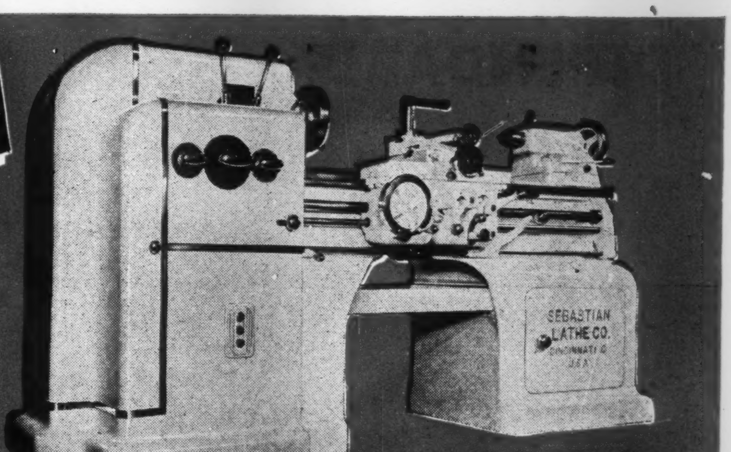
Dec. 9-11—

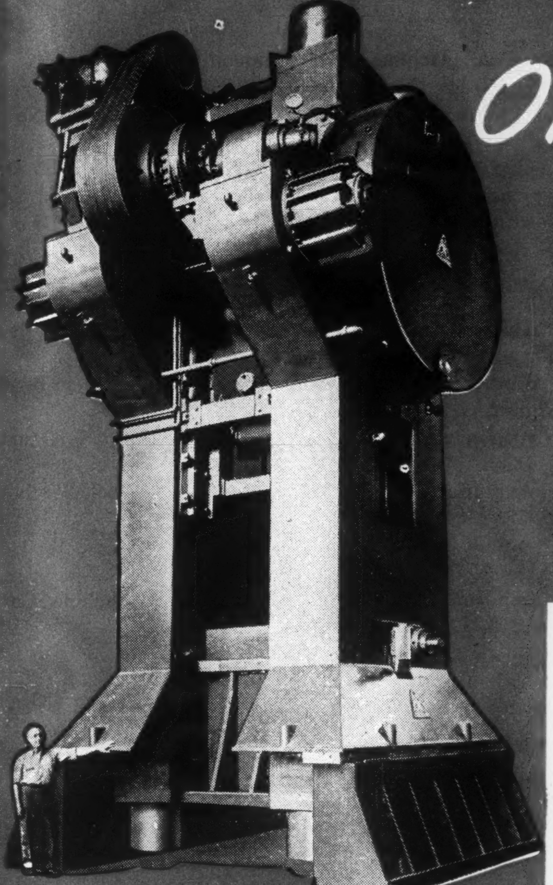
Society for Experimental Stress Analysis. Annual meeting to be held at Hotel New Yorker, New York. Additional information may be obtained from headquarters of the society at P. O. Box 168, Cambridge 39, Mass. W. M. Murray is secretary-treasurer.

Mr. Designer—

WHEN POWER DRIVES MUST *START SMOOTHLY—RUN SMOOTHLY—*

—Dayton V-Belts provide the answer. Dayton V-Belts are used on the drive of this modern lathe . . . no chatter at the spindle nose, nor chatter marks on the work it turns out.





OR ABSORB SHOCKS OF HEAVY BLOWS...

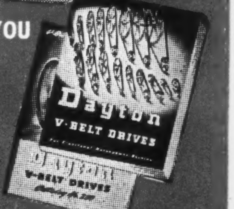
On this 4,000-ton mechanical forging press, 14 Dayton V-Belts, driven by a 200-horsepower motor, transmit up to 14,000 horsepower to the press ram at full flywheel speed. Despite its size, this press has a speed of 30 strokes per minute.

DAYTON V-BELTS WILL MAKE POSSIBLE THE EXACT POWER TRANSMISSION DRIVE THE PARTICULAR OPERATION DEMANDS...

TWO IMPORTANT CATALOGS YOU SHOULD HAVE IN YOUR FILES

Catalog 280—384 pages of V-Belt information listing millions of drive combinations.
Catalog 150—Complete data on fractional horsepower V-Belt Drives.

Write today for your copies of these catalogs.



Mr. Designer—

Dayton V-Belts make possible smooth power suitable for delicate machining or grinding operations. They do not generate or transmit vibration. They stand up under shock loads of all kinds. And to a large degree, they absorb heavy shock loads rather than pass them on to the bearings.

Back of every Dayton V-Belt are 40 years of research and experience in engineering *specialized* rubber products. This is reflected not only in the product itself but in the kind of counsel you can get from a Dayton Power Transmission Specialist.

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1, OHIO

V-Belts by

Dayton Rubber

THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

DEPENDABLE
Redmond
MICROMOTORS

★ AC—TYPE "T"

Totally enclosed 4 pole shaded pole Type "T" Micromotors are in sizes up to 1/25th horsepower. Built with sturdy die cast frames and Flush-Weld rotors. Air-Stream enclosed fan cooling provided on models T-110 and T-123. Compact model T-121, with external fins, is ideal for fan applications.

★ AC—TYPE "L"

4 pole shaded pole Micromotors built in sizes up to 1/40th horsepower. Rugged pressed steel cases designed for internal ventilation. Extra capacity lubrication gives these Micromotors unusually long life. Internal ventilating fan available for heavy duty use.

★ DC—SERIES

DC Redmond Micromotors are built for operation on 6 to 115 volts in sizes up to 1/20th H. P. Designed to meet the rigid requirements of the automotive industry especially. Suitable for heaters, defrosters, windshield wipers and antenna lifts.

★ BLOWERS

Dual or single blower units, powered by Type "L" Micromotors, are available for AC applications. For DC applications single blower units are equipped with Series type Micromotors. Blowers are attached to Micromotors with sound absorbing rubber grommets. Redmond Blowers are adaptable to any mounting position.

★ CONTROLLERS

Reactor type Redmond Controllers, for use with Type "T" Micromotors, provide desired speeds for specific fan applications and assure low power consumption. In addition to "off" position, available with either 1 or 2 speed reductions below high speed. Housing of heavy steel construction.

Redmond COMPANY, INC.
OWOSSO, MICHIGAN, U. S. A.

Five acres floor area ★ Over 2000 employees

NEW MACHINES

And the Companies Behind Them

Domestic

Home freezer units, International Harvester Co., Evansville, Ind.

Electric dishwasher, Edison General Electric Appliance Co. Inc., Chicago.

Electric dishwasher, Modern Maid Co., Chicago.

Electric dishwasher, American Central Mfg. Corp., Connersville, Ind.

Automatic oil burner, HomEase Products Div., Bogue Electric Co., Patterson 3, N. J.

Industrial

All-purpose floor machine, G. H. Tennant Co., Minneapolis.

Fire-fighter, Cardox Corp., Chicago.

Heavy-duty intercommunication units, Executone Inc., New York 17.

Portable sound system, Bell Sound Systems Inc., Columbus 3, O.

Vapor degreasers, Phillips Mfg Co., Chicago.

Nonoverheating solvent degreaser, The Mabor Co., Clark Township, N. J.

Metalworking

Special machine for rough and finish boring, Snyder Tool & Engineering Co., Detroit 7.

High-speed precision second operation machine, Hardinge Bros. Inc., Elmira, N. Y.

Electrically operated hydraulic press, Dake Engine Co., Grand Haven, Mich.

Large heavy milling machine, Diamond Machine Tool Co., Los Angeles 23.

Universal cutter and tool grinder, Covel Mfg. Co., Benton Harbor, Mich.

Medium-sized miller, The Cincinnati Milling Machine Co., Cincinnati 9.

Photographic

*Slide projector, Photographic Viewlex Inc., Long Island City 1, N. Y.

Testing

Two lead comparators, Michigan Tool Co., Detroit.

Dewpoint recorder, General Electric Co., Schenectady, N. Y.

Ductility testing machine, Steel City Testing Laboratory, Detroit 4.

Dynamometer truck for testing, The Goodyear Tire and Rubber Co., Akron, O.

Leak detector, General Electric Co., Schenectady, N. Y.

Soil moisture tester, Industrial Instruments Inc., Jersey City 5, N. J.

Laboratory circuit tester, Precision Apparatus Co., Inc., Elmhurst, N. Y.

Coil testers, General Electric Co., Schenectady, N. Y.

Test kit, The Miskella Infra-Red Co., Cleveland 4.

High altitude testing units, Bowser Inc., Terryville, Conn.

Magnetic field gage, General Electric Co., Schenectady, N. Y.

Halogenated hydrocarbon analyzer, Industrial Instruments Inc., Jersey City, N. J.

Large dial size pressure gage, United States Gauge Division, American Machine & Metals Inc., Sellerville, Pa.

Core-plate enamel tester, General Electric Co., Schenectady.

Welding

Soldering gun, Weller Mfg. Co., Easton, Pa.

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*Illustrated on Pages 98-99.

Directory of Materials

Thirteenth Edition

CONTINUING demand for machines of higher speed, greater automaticity, quieter operation and longer trouble-free life, emphasizes the intimate interdependence of design and materials. Progress in design would be greatly retarded were it not for recent outstanding developments in materials.

Cognizant of this important role of materials in machines of modern design, MACHINE DESIGN presents, in this Thirteenth Edition of its Directory of Materials, quick-reference listings of materials suitable for fabrication into machine parts. Outstanding properties of all materials are classified by convenient numerical keys placed above the tradename listings. Where numerals are shown only on the line immediately above the tradename, all types or grades produced under that tradename possess the properties designated by the numerals. When properties vary with the grades, classifying numerals appear above each individual grade to indicate its major properties.

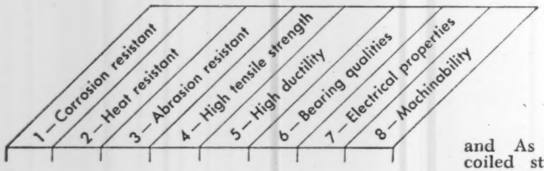
To facilitate selection of possible alternative materials, cross-reference listings are provided. These appear immediately following the tradename listings of metals, plastics and nonmetallics, respectively. The cross reference on metals is based on alloying constituents while those on plastics and non-metallics are arranged by types of material. In addition, all listings are cross referenced under the names of producers.

Many new types of metals, plastics and nonmetallics are included in the current directory, as well as complete revisions of materials data which appeared in earlier editions. The sections on stampings, forgings, die castings, finishes and custom molders also have been enlarged considerably.

Additional copies of this directory are available at one dollar each. Orders should be sent to Readers Service Department, MACHINE DESIGN, Penton Bldg., Cleveland 13, O., and a 3% state tax included for those originating in Ohio.

Iron, Steel and Nonferrous Metals Listed by Tradenames

(For listing by producing companies, and complete street addresses, see page 202. For index of alloys by principal constituents, see page 200)



A

- - 3 4 - - - -
ABK METAL—Brake Shoe and Castings Div., American Brake Shoe Co., New York. Ni-Cr alloy steel furnished as sand castings to specification. Ts, 55-80,000 psi; elong in 2 in., less than 0.05 per cent; bhn, 550-750; magnetic; weldability, poor; abrasion resistance, very high. Used where castings are subject to severe abrasion and where intricate machining and high impact are not encountered.

- 2 3 - - - - -
ABRASIST Cast Steel—Bethlehem Steel Co., Bethlehem, Pa. A heat and abrasion-resistant steel furnished in sand castings to specification. Typical composition: C 0.95, Mn 0.75, Si 0.40, Cr 2.50, Mo 0.35. Heat treated; bhn, 341; magnetic; weldability, poor. For jaws for grinding, wear plates, and where wear resistance is important.

See advertisement, Page 274

1 - 3 4 - - - -
ABRASOWELD—Lincoln Electric Co., Cleveland. Arc-welding electrode for providing abrasion-resisting, self-hardening deposit which hardens rapidly under impact and abrasion; maximum hardness develops at surface, leaving cushion of softer metal beneath. Provides resistance to abrasion in straight carbon, low-alloy or high-manganese steel surfaces; effective on gear and pinion teeth.

1 2 - - - - - -
ACCOLOY—Alloy Casting Co., Champaign, Ill. Analysis ranges from 18 per cent chromium, 8 per cent nickel to 68 per cent nickel and 10 per cent chromium. Furnished in wire, sheets and castings. It is nonmagnetic, and heat resistant to 2300 F. Weldability, good; abrasion resistance, low. Used for corrosion-resistant applications such as pump parts, tubing, chemical processing furnaces, etc., where resistance to corrosion and/or temperature is required.

- - - 4 5 6 - -
ACORN—A. W. Cadman Mfg. Co., Pittsburgh. Babbitt metal furnished in ingots; bhn at 70 F, 23.8; at 212 F, 21.8; comp str, 12,500 psi. For bearings having reciprocating motion, subject to excessive pounding or vibration.

- - - - - 6 - -
ADAMANT SUPER-GENUINE BABBITT—Magnolia Metal Co., Elizabeth, N. J. Over 90 per cent tin, free of lead, containing special fluxes; furnished as ingots; sp gr 7.34; bearing properties, good; bhn, untreated, 23. Used for bearings, diesel engines, connecting rods, etc., subject to shock or strain.

- - 3 - - - - -
ADAMANTINE—Babcock & Wilcox Co., New York. Special steel castings with wear-resisting qualities and machinable surfaces. For grinding mills, mixers, conveyors, power shovels, etc.

1 - - 4 - - - -
ADMIRALTY Metal—Revere Copper & Brass Inc., New York 17. Cu 71, Zn 28, Sn 1, and As 0.05; furnished in straight and coiled strip, tubing, sheet and plate; for machining, cold working, arc and gas welding. In cold-worked state: ts, 85,000 psi; ys, 70,000 psi; elong in 2 in., 5 per cent; hardness, 90 rockwell B; sp gr, 3.53; weldability, good; resists corrosion caused by saline waters; max cont. serv. temp, 450 F. For condenser tubes, plates, baffles, steampower plant equipment, and chemical and processing equipment parts.

See advertisements, Pages 263-264

1 2 3 - - - - -
ADNIC—Scovill Mfg. Co., Waterbury, Conn. Ni 29-32, Mn 1.0 max, Sn 0.75-1.25, Zn 1.0 max, Pb 0.05 max, and Fe 0.50 max, furnished in finished rods or bars, straight and coiled strip, tubing, wire and sheet; for machining, hot and cold working, stamping, drawing, brazing, and arc, gas and resistance welding. In cold-worked state: ts, 90,000 psi; ys, 89,000 psi; elong in 2 in., 2 per cent; impact str at 70 F, 60 ft-lb (Charpy); sp gr, 8.94; resists corrosion caused by many acids, alkalies and salt solutions; max cont. serv. temp, 700 F; abrasion resistance, high. For applications requiring high resistance to corrosion and high strength.

See advertisement, Page 295

- 2 - - - - 7 -
ADVANCE—Driver-Harris Co., Harrison, N. J. Cu 55, Ni 45; resists heat to 1500 F; thermocouple material. For applications where low-temperature coefficient of resistivity is required; also for measuring instruments, industrial and radio rheostats and elevator controls.

- - - 4 - 6 - -
AERISWELD—Lincoln Electric Co., Cleveland. Arc-welding electrode; for welding of bronze, brass and copper, either in manufacturing or maintenance work.

1 - 3 - - 6 - -
AETERNA 600 Alloy—Mueller Brass Co., Port Huron, Mich. Cu 60, Zn 38 and balance of Mn, Si and Al. Furnished in finished rods or bars, tubing, and in forgings, for extruding and hot forgings. Ts, 85-90,000 psi; nonmagnetic; weldability, good; abrasion resistance, low. For bearings, gears, cams, levers, etc.

1 2 - 4 5 6 - 8
AGALOY Tubing—Agaloy Tubing Co., Springfield, O.

- - - 4 - 6 - 8
Welded, spiral brazed and seamless tubing of carbon steels SAE 1010 to 1095, alloy steels SAE 4130 to 4150, SAE 6115 to 6195, and SAE 52100.

1 2 - 4 - - - -
Cold drawn welded tubing of stainless steels AISI types 304, 316, 317, 321, 329, 347 and 430. Cold-drawn seamless tubing of stainless steels AISI types 304, 308, 316, 317, 321, 347, 410, 430 and 446. For property and application data see "Stainless Steels" listing elsewhere in this section.

1 2 - - 5 - - -
Monel, Inconel and nickel tubing for applications requiring high resistance to corrosion, oxidation and scaling, combined with good strength at high temperatures, good ductility and impact strength at low temperatures.

Composite tubing made up of two or more different metals to specification.

- - 3 - 5 - - 8
AGILE—American Agile Corp., Cleveland 3.

- - 3 - - - - 8
Silver-green electrode; C 0.8, Si 1.4, W 1.7, and B 0.15. To increase impact strength, metal should be draw cooled between 400 and 650 F. In untreated state: Impact resistance, high; hardness, 50-55 rockwell C; sp gr, 7.85; magnetic; abrasion resistance, high. For machine parts exposed to heavy impact.

- - 3 - 5 - - -
Violet electrode; C 1.3, Mn 12-14, and Ni 0.8. No heat-treatment necessary, deposited weld metal is work hardening. In untreated state: Ts, 100,000 psi; impact resistance, high; bhn, 180-225; sp gr, 7.8; nonmagnetic; abrasion resistance, high. For surfacing of parts exposed to extreme wear and impact.

- - 3 - - - - -
Pink electrode; C 0.22, and Mn 0.95. No heat treatment required. In untreated state: Impact resistance, medium; bhn, 200-250; sp gr, 7.8; magnetic; abrasion resistance, medium. For hard surfacing where subsequent machining is required.

- - 3 - - - - -
Dark green electrode; C 0.6, Mn 0.9, Cr 0.4. No heat treatment required. In untreated state: Impact resistance is high; bhn, over 400; sp gr, 7.8; magnetic; abrasion resistance, high. For hard facing where impact and abrasion resistance is important.

Silver blue electrode; C 0.9, Mn 1.3, Cr 0.5, W 1.5. Hardness rockwell C, 60-63; sp gr, 7.8; magnetic; abrasion resistance, high.

- - - - - - - 8
Yellow electrode; Cu 30, Ni 68, Fe 2. Bhn, 150; nonmagnetic; machinability, good. For welding cast iron and dissimilar metals.

- 2 3 - - - - -
AGILE-ACTARC—American Agile Corp., Cleveland. Electrodes for welding sheet metal, fillet welding, cast-iron welding, and hardfacing.

1 2 - - - 6 - -
AGRICOLA—Saginaw Bearing Co., Saginaw, Mich. Bearing bronze of Cu 70, Pb 30; impurities less than 0.2 of 1; resists corrosion caused by acids; resists heat to 500 F; ductility, medium. Especially adapted to diesel and airplane engine bearings.

See advertisement, Page 132

1 - - 4 - - - 8
ALCLAD—Aluminum Co. of America, Pittsburgh.

14S: same as ALCOA 14S composition; sheet, plate; ts, 59-65,000 psi. For general structural applications where high resistance to corrosion and high strength are required.

24S: same as ALCOA 24S composition; sheet and plate; same strength as ALCOA 24S. For structural construction in aircraft.

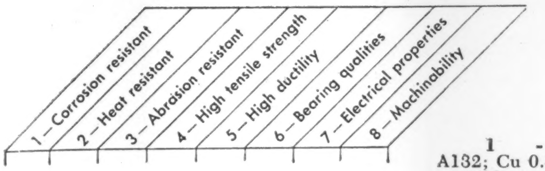
75S: composition same as ALCOA 75S; sheet and plate; ts 76,000 psi. For structural uses in aircraft; strong aluminum alloy.

3S: same as ALCOA 3S composition; tubing; ts, 15-28,000 psi. For handling liquids where corrosion is a problem.

See advertisements, Pages 267, 271, 287

1 - - 4 5 6 7 8
ALCOA—Aluminum Co. of America, Pittsburgh. Aluminum wrought and casting alloys as follows.

1 - - - 5 - 7 -
2S; commercially pure aluminum sheet and plate, rod, bar, wire, rivets and press forg-



ings. Ts, 13-24,000 psi. For sheet-metal work, chemical equipment and chemical conductors.

3S; Mn 1.2; in sheet and plate, extruded shapes, tubing, rod, bar and wire; ts, 16-29,000 psi. For sheet-metal work and gasoline tanks for aircraft and chemical equipment.

- - - 4 - - - 8

11S; Cu 5.5, Pb 0.5, Bi 0.5; wire, rod and bar, screw machine products; ts, 53-57,000 psi.

14S; Cu 4.4, Si 0.8, Mn 0.8, Mg 0.4; heat-treatable forgings, extruded and rolled shapes; ts, 60-70 000 psi. For heavy-duty forgings power shovel bails, airplane fittings, etc.

17S; Cu 4, Mn 0.5, Mg 0.5; furnished in rod and bar, wire rivets forgings and screw machine products; ts, 62 000 psi. For structural applications in transportation fields.

- - - - 5 - - 8

A17S; Cu 2.5, Mg 0.3; rivets; ts, 43,000 psi. For aircraft; rivets can be driven in fully heat-treated condition.

- - - 4 - - - 8

18S; Cu 4, Mg 0.5, Ni 2; heat-treatable forgings; ts, 63 000 psi. Used for forged aircraft engine pistons where good strength at elevated temperatures is required.

1 - - 4 - - - 8

24S; Cu 4.5, Mn 0.6, Mg 1.5; sheet and plate, rod and bar, wire, tubing, extruded shapes, rivets ts 68 73 000 psi. For structural construction in aircraft.

- - - 4 - - - 8

25S; Cu 4.5, Si 0 8, Mn 0.8; forgings for airplane propellers; ts, 57,000 psi.

32 S; Cu 0 9, Si 12.5, Mg 1, Ni 0.9; heat-treatable forgings for pistons, low coefficient of expansion; ts, 56,000 psi.

1 - - 4 - - - 8

A51S; Si 1, Mg 0.6, Cr 0.25; heat-treatable forgings for machine and automotive parts, especially for intricate forgings; ts, 47,000.

1 - - - 5 - - -

52S; Mg 2.5, Cr 0.25; furnished in sheet and plate, tubing, rod, bar and wire; marine and transportation applications; ts, 29-41,000.

1 - - - 5 - - 8

53S; Si 0.7, Mg 1.3, Cr 0.25; furnished in wire, rolled and extruded shapes, rivets, screw machine parts and forgings; ts, 33-39 000 psi. For structures subject to severely corrosive conditions in naval and industrial applications.

1 - - 4 - - - -

56S; Mg 5.2, Mn 0.1, Cr 0.1; wire and rivets; ts, 42-58 000 psi For joining magnesium and for cable sheathing.

1 - - 4 5 - - 8

61S; Cu 0.25, Si 0.6, Mg 1, Cr 0.25; ts, 35-45 000 psi; in sheet and plate, tubing, rolled and extruded shapes, wire, rod and bar For applications in shipbuilding and transportation fields.

1 - - 4 - - - 8

75S; Cu 1 6 Mn 0.2, Mg 2.5, Zn 5.6, Cr 0.3; sheet, plate, rod bar, wire and extruded shapes ts 88 000 psi. For structural applications in aircraft.

1 - - 4 - - - -

13; Si 12 ts, 37,000 psi; a general-purpose die casting alloy for large, intricate parts.

1 - - - 5 - - -

43; Si 5 ts 19 30,000 psi; available as sand, permanent mold and die castings. For castings that must be leakproof under pressure such as sewage disposal plant and pipe fittings.

- - - 4 - - - 8

85; Cu 4 Si 5; ts 40 000 psi. General-purpose die casting alloy for brackets, frames and levers with thick sections.

1 - - - - - - -

108; Cu 4, Si 3; furnished as sand castings for manifolds, valves and other intricate castings requiring pressure tightness; ts, 21,000 psi.

A108; Cu 4.5, Si 5 5; furnished as permanent-mold castings for general-purpose castings of intricate design; ts, 28 000 psi.

C113; Cu 7, Si 3.5; permanent mold castings for automotive-engine cylinder heads; ts, 30,000 psi.

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122; Cu 10, Mg 0.2; sand and permanent-mold castings for automotive pistons, camshaft bearings, valve tappet guides; ts, 27-40,000.

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A132; Cu 0.8, Si 12, Mg 1, Ni 2.5; permanent-mold castings for pistons; ts, 36-47,000 psi.

138; Cu 10, Si 4, Mg 0.3, Fe 1; permanent-mold castings for flat iron sole plates; retains strength and hardness at elevated temperatures; ts, 28,000 psi.

- - - 4 - - - 8

142; Cu 4, Mg 1.5, Ni 2; sand and permanent-mold castings for pistons and aircooled cylinder heads; ts, 27-47,000 psi.

195; Cu 4.5, Si 0.8; sand castings for general structural purposes; ts, 32-40,000 psi.

B195; Cu 4.5, Si 2.5; permanent-mold castings for general structural purposes; ts, 39-45,000.

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212; Cu 8, Si 1.2 sand castings for general purposes; ts, 23,000 psi.

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214; Mg 3.8; sand castings; ts, 25 000 psi. For marine fittings machine parts; has high resistance to salt-water corrosion.

A214; Zn 1.8, Mg 3.8; permanent-mold castings for marine fittings and hardware; ts, 27,000 psi.

1 - - 4 - - - -

218; Mg 8; ts, 42,000 psi; furnished as die castings for marine fittings and hardware.

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220; Mg 10; sand castings; ts, 46,000 psi; for aircraft fittings, railroad car parts, heavy-duty castings, power shovel dipper parts, marine applications; high-strength sand-casting alloy.

- - - 4 - - - -

355; Cu 1.3, Si 5, Mg 0.5; permanent-mold and sand castings; ts, 28-45 000 psi. For cylinder heads and crankcases for diesels and liquid-cooled aircraft engines.

1 - - 4 - - - 8

356; Si 7, Mg 0.3; permanent-mold and sand castings; ts, 25-40 000 psi. For high-strength pressure-tight castings of intricate shape.

1 - - 4 5 - - -

360; Si 9.5, Mg 0.5; die castings; ts, 42,000 psi; general-purpose alloy for large, intricate castings a substitute for alloy 113 for castings to be made in a cold chamber machine.

- - - 4 5 - - -

380; Cu 3.5, Si 8.5; ts, 45,000 psi; a high-strength general-purpose die casting alloy.

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113; Cu 7, Si 2, Zn 1.7; sand and permanent-mold castings; ts, 24-28,000 psi. For crankcases, oil pans, cylinder heads, and other automotive applications.

152; Cu 7, Si 3.5, Mg 0.3; permanent-mold castings; ts, 29-35,000 psi. For automotive pistons.

1 - - - - - - -

B214; Si 1.8, Mg 3.8, sand castings; ts, 20,000 psi. For pipe fittings etc; has high resistance to salt water corrosion.

F214; Si 0.5, Mg 3.8; sand castings; ts, 20 000 psi. For architectural applications and hardware; provides light-colored anodic coating.

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319; Cu 3.8, Si 6; sand and permanent-mold castings ts, 29-40,000 psi. For general purposes.

333; Cu 3.8, Si 9, Mg 0.4; permanent-mold castings; ts, 32,000 psi. For automotive pistons.

- - - - - 6 - 8

750; Cu 1, Ni 1, Sn 6.5; permanent-mold castings. Ts, 20 000 psi. For bearing inserts in high-duty internal combustion engines as connecting rod, main and thrust bearings.

See advertisements, Pages 267, 271, 287

1 - - 4 5 - - -

ALDECOR—Alloys Development Co., Pittsburgh, Pa. Steel containing molybdenum, copper, silicon and phosphorus, furnished in rough bars or billets, finished rods or bars straight and coiled strip, sheets and plates for turning, boring, forging, stamping and welding. In untreated state: Ts, 70 000 psi min; ys, 50,000 psi min; elong in 2 in., 22 per cent min; sp gr is same as ordinary steel; weldability, good; resists corrosion caused by atmospheric exposure; abrasion resistance, medium. Used in transportation equipment to reduce dead weight. Also produced by Republic Steel Corp.

- - - 4 5 - - -

ALLCAST—The National Smelting Co., Cleveland 5. Cu 3, Si 5 (nominal); furnished in rough bars or billets, and as sand, precision and permanent-mold castings. Various heat-treatments for various requirements. In heat-treated state: Ts, 34,000 psi; ys, 19,000 psi; elong in 2 in., 3.5; impact str, 1.6 ft-lb (Charpy); bhn, 80; sp gr, 2.75; nonmagnetic; weldability, good; max cont. serv. temp, 300 F; abrasion resistance, medium. For internal combustion engines, machine frames, etc.

- - - - - - 7 -

ALLEGHENY LUDLUM — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

"4750"; a high permeability nickel-iron alloy containing approximately 48 per cent nickel, balance iron, that must be hydrogen annealed after fabrication. Available in form of sheets, flats, squares, strip, etc.; also in the form of laminations and shields. Used in audio transformers sensitive relays, and electrical instruments.

"88-x"; a nonmagnetic high-strength alloy material, not at all stainless, which finds applications for mountings in power transformers, and on high-current bus boards in power generating stations and substations. Typical analysis—C .3, Mn 10, Ni 8, bal., Fe.

Electrical steels; furnished in coiled strip and sheets for manufacture of laminations. Used in construction of motors, transformers, relays, electromagnets, radios, etc. These steels contain ½-5 per cent silicon, depending on the application.

Relay steels; annealed silicon steel rounds, flats, squares etc., containing ½-2¾ per cent silicon, which find wide application for relays, electromagnets, etc.

Laminations for transformers, motors, and miscellaneous small electrical equipment and parts. Made from all grades of silicon steel and from high permeability alloys, such as Allegheny Ludlum "4750" and Allegheny Ludlum Mumetal.

Cast resistance grids: No. 17 metal. Castings having high electrical resistance and ability to withstand continued severe mechanical shock even at high temperatures. Applications include motor starters, crane motor controls mine locomotive controls, and power house equipment.

See advertisement, Page 313

1 2 3 4 5 - - 8

ALLEGHENY METALS — Allegheny Ludlum Steel Corp., Brackenridge, Pa. Standard stainless steels of AISI Types 301, 302, 303A, 303C, 303S, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 410, 414, 416, 418, 420, 430, 431, 440A, 440C, 446, 501, 501 plus Mo 502, 502 plus Mo. For property and application data, see "Stainless Steels" listing elsewhere in this section.

See advertisement, Page 313

1 2 - 4 - - - -

ALMET Stainless Steels—Alloy Metal Wire Co. Inc., Prospect Park, Pa. Standard stainless steel rods bars strip and wire in AISI Types 302, 303, 304, 308, 309, 310, 316, 321, 330, 347, 410, 416, 420, 430, 434, 442, 446. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

- - - - - - 7 -

ALNICO—General Electric Co., Schenectady, N. Y. Permanent-magnet alloy of high coercive force. Iron, nickel and aluminum as basic ingredients. Extremely hard, generally must be ground. Available in both sintered and cast form. Sintered Alnico furnished by General Electric and cast Alnico by the following: Arnold Engineering Co., Chicago; Belden Mfg. Co., Chicago; Cinaudagraph Corp., Stamford, Conn.; Crucible Steel Co. of America, New York; General Magnetic Corp., Chicago; Indiana Steel Products Co., Chicago; Simonds Saw & Steel Co., Lockport, N. Y.; Taylor Wharton Iron & Steel Co., High Bridge N J; and Thomas and Skinner Steel Products Co., Indianapolis.

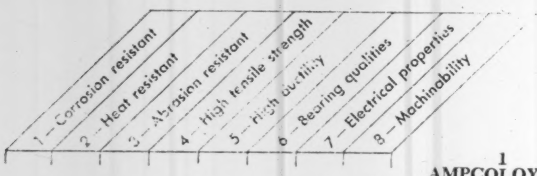
1 2 - 4 - - - -

ALRAY—Alloy Metal Wire Co., Inc., Prospect Park, Pa. Electrical resistance alloys round and flat wire, rod and strip.

A; Cr 20; Ni, 80. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp 2000 F; has good weldability.

C; Cr, 15; Ni, 62; balance Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp. 1700 F.

D; Cr, 18; Ni, 35; balance, Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont. serv. temp 1400 F.



- - - - - - 7 8
ALTERNEX—Metal & Thermit Corp., New York. Arc welding electrode producing deposit of 62-75,000 psi ts; ys, 52-61,000 psi; elong in 2 in., 17-25 per cent. For guards, furnaces, tanks and other light-gage fabrication.

- - - 4 - - - -
ALUMINWELD—Lincoln Electric Co., Cleveland. A 5 per cent silicon-aluminum-alloy electrode for arc-welding aluminum in any form —cast, sheet, shapes, or extruded forms. For either metallic or carbon arc welding. Welds are very dense without porosity and possess high tensile strength.

1 2 - 4 - - - -
AMBRAC—American Brass Co., Waterbury, Conn. Alloy 850; Cu 75, Zn 5, Ni 20; high ductility. Used for condenser tubes, etc.

See advertisements, Pages 297-298

1 2 - - - - 7 -
AMERICAN—American Nickeloid Co., Peru, Ill. Bonded metals; chromium, nickel, brass, copper, gold resemblance and colors bonded to base metals such as steel, tin-plate, zinc, brass, copper, aluminum and nickel silver. Available in brilliant finishes and patterns as sheets, flat strips, coiled strip and round edge flat wire. Can be supplied with gum-adhered paper covering protecting prefinish in drawing and preforming.

Copper steel; copper plated to steel, latter serving as rust resistant, inexpensive metal, conserving quantities of critical solid copper. Available in polished and unpolished finishes in sheets, flat strips and coiled strip for continuous feed automatic presses.

- - - - - 6 - 8
AMERICAN Marine Genuine Babbitt—United American Metals Corp., Brooklyn 22. Furnished in bars. In cold-worked state: Ts, 8750 psi; comp str, 10,140 psi; ys, 8000 psi; elong in 2 in., 1.00 per cent. For heavy-duty marine engines.

- - - - 5 - - 8
AMERICAN QUALITY—American Steel & Wire Co., Cleveland. Carbon steels and alloys in the form of cold-rolled strip, manufacturer's wire and springs.

- - - - 5 - - -
AMERCUT—American Steel & Wire Co., Cleveland. Cold finished carbon and alloy steel bars either cold drawn, annealed, normalized, spheroidized or quenched and tempered to meet various combinations of definite physical, magnetic, corrosion-resistant or machinability properties specifications.

- - 3 4 - - - -
AMOLA—Chrysler Corp., Detroit. Also made by various steel companies as licensees under patent controlled by Chrysler Corp.. Machinery and constructional steels furnished in 20 grades which vary in analyses only in regard to carbon content. Basically the analysis is Mn 0.7-0.9, P (max) 0.04, S (max) 0.04, Si 0.2-0.3, and Mo 0.15-0.25. Used for carburized gears, axle shafts, and springs, with as little thickness as 0.005-inch.

MS 244 electric furnace, C 0.66-0.7.

MS 245 open hearth; entire formula same as MS 244.

MS 246 electric furnace; C 0.6-0.65.

MS 247 open hearth; C same as MS 246.

MS 248 electric furnace; C 0.55-0.6.

MS 249 open hearth; C same as MS 248.

MS 260 electric furnace; C 0.5-0.55.

MS 261 open hearth; C same as MS 260.

MS 262 electric furnace; C 0.45-0.5.

MS 263 open hearth; C same as MS 262.

MS 266 electric furnace; C 0.4-0.45.

MS 267 open hearth; C same as MS 266.

MS 268 electric furnace; C 0.35-0.4.

MS 269 open hearth; C same as MS 268.

MS 270 electric furnace; C 0.3-0.35.

MS 271 open hearth; C same as MS 270.

MS 276 electric furnace; C 0.25-0.3.

MS 277 open hearth; C same as MS 276.

MS 290 electric furnace; C 0.20-0.25.

MS 291 open hearth; C same as MS 290.

1 - 3 4 5 6 - -
AMPCOLOY—Ampco Metal Inc., Milwaukee 4. Various grades of copper-base alloys.

1 - 3 - 5 - - -
Grade A-3; Cu 89, Al 10, Fe 1; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good properties to 1000 F; ts, 70,000 psi; ys, 26,000 psi; bhn, 3000-kg, 115; fair abrasion resistance; high ductility; nonmagnetic; good bearing properties. Used for bushings, bearings, and pickling equipment. Can be forged and welded.

1 - - 4 - 6 - -
Grade A-323; heat-treated, to A-3 analysis above. Furnished as sand or centrifugal castings, rods and bars. Corrosion-resistant. Good physical properties to 750 F; ts, 80,000 psi; ys, 40,000 psi; bhn, 3000-kg, 145; high ductility; good abrasion resistance; nonmagnetic; excellent bearing properties. Used for bushings, bearings, gears and sleeves; also screw-down nuts; can be forged and welded.

Grade E-1; analysis similar to A-3 above; furnished as sand or centrifugal castings. Corrosion-resistant. Good physical properties to 1000 F; ts, 75,000 psi; ys, 30,000 psi; bhn, 3000-kg, 140; fair abrasion resistance; fair ductility; nonmagnetic; good bearing properties. Used for bearings, bushings, gears and pickling equipment.

Grade E-117; analysis similar to A-3 above. Heat-treated. Furnished as sand or centrifugal castings. Corrosion-resistant. Good physical properties to 750 F; ts, 90,000 psi; ys, 66,000 psi; bhn, 3000-kg, 225; good abrasion resisance; nonmagnetic. Finds use in special applications. Can be welded or forged.

- - 3 4 5 - - -
Grade 46-22; Cu balance, Al 10-11, Fe 4-6, Ni 4-6; furnished as sand castings, rods or bars. As heat-treated: Ts, 110,000 psi; ys, 60,000 psi; elong 10 per cent; reduction of area, 8 per cent; bhn, 3000-kg, 217-348. For use where strength with ductility is required. Can be forged and welded.

- - 3 4 - - - -
62, 64 and 66; a series of low, medium and high-strength manganese bronzes. Furnished as sand or centrifugal castings. Ts, from 65-110,000 psi; ys, 30-65,000 psi; bhn, 3000-kg, 115-215. Finds many uses for structural parts not requiring best bearing characteristics. Can be readily forged and all three grades are weldable.

- - - 4 - - 7 -
86; beryllium-copper; Cu 96.3; Be 2.5; Ni 1.2; furnished as sand or centrifugal castings; heat-treated, ts 100,000 psi; ys, 90,000 psi; bhn, 3000-kg, 400. Used for welding dies and safety tools.

91 and 97; high conductivity copper-chromium and copper-cobalt, beryllium alloys; supplied as sand or centrifugal castings; before final heat treatment can be forged; high electrical thermal conductivity. Used as welding wheels, electrodes, collector rings, collector shoes, current-carrying parts of electrical and other machinery.

1 - - - - 6 - 8
Grade 342; Cu 75, Sn 5, Pb 20. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 31,000 psi; ys, 18,000 psi; elong in 2 in., 14 per cent; bhn (500-kg) 57; nonmagnetic; weldability, poor; corrosion resistance, high. For soft bronze bearings, bushings, seals, seat rings, etc.

Grade 346; Cu 80, Sn 10, Pb 10. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 48.000 psi; ys, 25,000 psi; elong in 2 in., 15 per cent; bhn (500-kg) 78; nonmagnetic; for general-purpose bronze bearings, bushings, seals, seat rings, etc.

Grade 351; Cu 75, Sn 10, Pb 15. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 40,000 psi; ys, 22 000 psi; elong in 2 in., 13 per cent; bhn (500-kg) 72; nonmagnetic; corrosion resistant to weak acids such as mine waters. For bearings, bushings, pump seals, valve seats, etc.

Grade 382; Cu 83, Sn 7, Pb 7, Zn 3. Furnished in 10-ft lengths of continuous-cast bars. Untreated, ts is 44,000 psi; ys, 22,500 psi; elong in 2 in., 24 per cent; bhn (500-kg) 76; nonmagnetic. For general-purpose bearings, bushings, seals, etc.

Grade 384; Cu 85, Sn 5, Pb 9, Zn 1. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 42.000 psi; ys, 21.000 psi; elong in 2 in., 20 per cent; bhn (500-kg) 67; nonmagnetic; for general-purpose bearings, bushings, seals, etc.

Grade 583; Cu 84, Sn 10, Pb 2.5, Ni 3.5. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 50,000 psi; ys, 30,000 psi; elong in 2 in., 20 per cent; bhn (500-kg) 85; nonmagnetic. For high-strength bearings, bushings, etc.

Grade 742; Cu 88, Sn 10, Zn 2. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 52,000 psi; ys, 27,000 psi; elong in 2 in., 22 per cent; bhn (500-kg) 85; nonmagnetic. For hard bronze gears, bearings, bushings, valve stems, shafting, seat rings, etc.

Grade 782; Cu 85, Sn 5, Pb 5, Zn 5. Furnished in 10-ft lengths of continuous-cast bars and tubes. Untreated, ts is 43,000 psi; ys, 22,000 psi; elong in 2 in., 25 per cent; bhn (500-kg) 67; nonmagnetic. For bearings, bushings, pump seals, valve seats, etc.

1 - 3 - - - - -
Grade 40; Al 9.5-10.5, Fe 0.20 max, Cu balance. Furnished in rough bars or billets and finished rods and bars. Untreated, ts is 70,000 psi; ys, 25,000 psi; elong in 2 in., 20 per cent; bhn (3000-kg), 130; nonmagnetic; resists sulphuric acid. For pump valves in acid service, etc.

Grade 44; Al 11-12, Fe 0.20 max, others 0.25 max, Cu balance. Furnished in centrifugal castings, rough bars or billets and wire. Untreated, ts is 70,000 psi; ys, 35.000 psi; elong in 2 in., 2 per cent; bhn (3000-kg), 185. For welding dies electrode holders, flash and butt welding jaws, etc.

- - - 4 5 - - -
Grade 45-22; Al 9.7-10.9; Fe 2.0-3.5; Ni 4.5-5.5, Mn 1.5 max, others 0.5, Cu balance. Furnished as castings, rough bars or billets, and finished rods and bars. Heat treated, ts is 105.000 psi; ys, 55,000 psi; elong in 2 in., 10 per cent; bhn (3000-kg) 200; nonmagnetic; weldability, good; resists weak acids. For gears, bearings, shafts, etc.

Grade 50; Cu 83-85; Sn 9.5-10.5, Pb 2-3, Ni 3-4, others 0.25 max. Furnished in form of rough bars or billets. Untreated, ts is 40,000 psi; ys, 22,000 psi; elong in 2 in., 15 per cent; bhn (500-kg), 80; nonmagnetic; weldability, poor; abrasion resistance, medium. For worm gears where speeds are high with light to moderate loads.

- - - - - 6 - 8
Grade 71; Cu 86-90; Sn 5.5-6.5; Pb 1-2; Zn 3-5, P 0.05 max, Fe 0.25 max, Ni 1.0 max, others 0.2 max. Furnished in form of rough bars or billets. Untreated, ts is 34,000 psi; ys, 16.000 psi; elong in 2 in., 22 per cent; bhn (500-kg), 60; nonmagnetic. For pressure castings, gears, bushings, bearings, etc.

Grade 72; Cu 86-89, Sn 7.5-9.0, Pb 0.3 max, Zn 3-5, P 0.05 max, Ni 1.0 max, others 0.2 max. Furnished in form of rough bars or billets. Untreated, ts is 40.000 psi; ys, 20,000 psi; elong in 2 in., 20 per cent; bhn (500-kg), 60; nonmagnetic; weldability, fair. For bushings, bearings, etc.

Grade 74; Cu 84-86, Sn 4-6, Pb 4-6, Zn 4-6, P 0.05 max, Fe 0.3 max, Ni 1.0 max, others 0.2 max. Furnished in rough bars or billets and sand and permanent-mold castings. Untreated, ts is 30 000 psi; ys, 18,000 psi, elong in 2 in., 20 per cent; bhn (500-kg), 55; nonmagnetic; weldability, fair. For valves, pipe elbows, etc., for applications up to 350 lb.

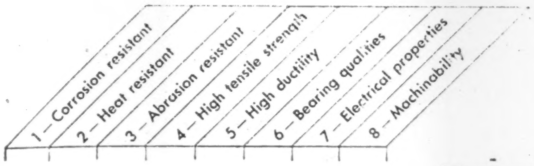
- - 3 - - 6 - -
Grade 79; Cu 86-89, Sn 9-11, Pb 0.3 max, Zn 1-3, P 0.05 max, Fe 0.15 max, others, 0.2 max. Furnished in rough bars or billets. Untreated, ts is 40,000 psi; ys, 20 000 psi; elong in 2 in., 16 per cent; hardness, 70 rockwell F; nonmagnetic; weldability fair; abrasion resistance, medium. For bushings, bearings, gears, etc.

See advertisement, Page 288

1 - 3 4 5 6 - -
AMPCO METAL—Ampco Metal Inc., Milwaukee 4. Special copper-base alloys produced in several grades. Data which follows gives chemical compositions and physical properties.

1 - 3 - - 6 - -
Grade 12; Cu balance, Al 8.5-9.3, Fe 2.50-3.25, others 0.50 max; furnished as sand or centrifugal castings; rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 70 000 psi; ys, 28 000 psi; comp str, 120,000 psi; sp gr, 7.73; bhn, 3000-kg, 115; elong, 25 per cent min; abrasion-resistant; nonmagnetic. Good machinability, can be forged and welded.

1 - - 4 - 6 - -
Grade 15; Cu balance, Al 9-10, Fe 2.75-4.0, others 0.50 max; furnished as solid or hollow rods and bars or sheet. Corrosion-resistant. Good physical properties to 1000



F; ts, 85,000 psi; ys, 40,000 psi; sp gr, 7.62; bhn, 3000-kg, 160; elong, 25 per cent; abrasion-resistant; nonmagnetic; has good surface finish; good bearing qualities. Used for bushings, bearings, small worm wheels, bolts, nuts or studs.

- - 3 - - - - -
Grade 18-13; Al 10.30-11.0, Fe 3-4.24, others 0.50 max, balance Cu. Furnished in form of rough bars or billets, finished rods and bars, and sand and permanent-mold castings. Heat treated, ts is 80,000 psi; ys, 32,000 psi; elong in 2 in., 16 per cent; bhn (3000-kg), 150; nonmagnetic; max cont. serv. temp, 400 F. Uses similar to Grade 18.

Grade 18-22; Al 10.30-11.20, Fe 3.0-4.25; others 0.50 max, balance Cu. Furnished as rough bars or billets, finished rods and bars, and permanent-mold and sand castings. Heat treated, ts is 95,000 psi; ys, 50,000 psi; elong in 2 in., 4 per cent; bhn (3000-kg), 212; nonmagnetic; weldability, good; abrasion resistance, high; max cont. serv. temp, 400 F. For bearings, guides, wear strips, etc.

1 - - 4 5 - - -
Grade 16; Cu, balance, Al 9.80-10.30, Fe 3-4, others 0.50 max; furnished as sand or centrifugal castings. Corrosion resistant. Good physical properties to 1000 F; ts, 85,000 psi; ys, 32,000 psi; comp str, 125,000 psi; sp gr, 7.62; bhn, 3000-kg, 140; elong, 20 per cent; abrasion-resistant; nonmagnetic. Used for bushings, bearings, gear slides and shifter forks. Good machinability; can be forged and welded.

1 - 3 4 - - - -
Grade 18; Cu, balance, Al 10.30-11.0, Fe 3.0-4.25, others 0.5 max; furnished as sand or centrifugal castings; also as rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 85,000 psi; ys, 35,000 psi; comp str, 136,000 psi; sp gr, 7.58; bhn, 3000-kg, 170; elong 16 per cent; abrasion-resistant; nonmagnetic. Used as heavy-duty bushings, bearings, gears, worm wheels, feed nuts and pickling equipment. Fair machinability.

Grade 18-23; heat-treated version of Grade 18 above. Furnished as sand or centrifugal castings, rods or bars. Corrosion resistant. Good physical properties to 750 F; ts, 100,000 psi; ys, 45,000 psi; comp str, 15,000 psi, sp gr, 7.60; bhn, 3000-kg, 190; elong 14 per cent; abrasion-resistant; nonmagnetic. Used where high strength, good bearing properties and wear resistance is required. Ideal for heavy-duty worm gears.

Grade 20; Cu, balance, Al 11.40-12.20, Fe 3.25-4.50, others 0.5 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 85 000 psi; ys, 38 000 psi; comp str, 146,000 psi; sp gr 7.43; bhn, 3000-kg, 230; high abrasion resistance; nonmagnetic. Used as cams, cam rollers, welding jaws, bushings and bearings (wherever high resistance is required).

Grade 21; Cu, balance, Al 12.60-13.40, Fe 3.5-5.0, others 0.50 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts, 75 000 psi; ys, 45 000 psi; comp str 160 000 psi; sp gr 7.14; bhn, 3000 kg, 300; high abrasion resistance; nonmagnetic. Used in drawing and forming dies, bushings and liners, replacing steel.

Grade 22; Cu, balance, Al 13.7-14.4, Fe 4.0-5.25, others 0.50 max; furnished as sand or centrifugal castings, rods or bars. Corrosion-resistant. Good physical properties to 1000 F; ts. 80,000 psi; ys, 60 000 psi; comp str, 171 000 psi; sp gr, 7.21; bhn, 3000-kg, 330; high abrasion resistance; nonmagnetic. Used as cam rollers, wear strips, forming and drawing dies. Can be forged and welded.

See advertisement, Page 288

1 - 3 4 - - - -
AMPCO-TRODE—Ampco Metal Inc., Milwaukee 4. Coated weldrod in various aluminum bronze alloys listed under Ampco Metal. Used for weldrod overlays on steel, cast iron, brass or bronze repairing with high strength bronze rod of practically all metals.

See advertisement, Page 288

1 2 3 4 5 6 - -
AMSCO—American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill.

- - - 4 5 - - -
Manganese Steel; C 1-1.40, Mn 10-14, Si 0.25-1.00, P 0.10 max, balance Fe. Furnished in sand castings to specification. Ts (heat treated), 100-135,000 psi; ys, 30-55,000 psi; elong in 2 in., 30-55 per cent; bhn, 200; magnetic permeability, 1.03-1.10; weldability, good; max cont. serv. temp, 500 F; abrasion resistance, medium. For dippers, gears, plows, oil well parts, chains, crusher parts, bucket lips, spindles, guides, conveyor parts, dredge buckets, etc.

- - 3 4 - - - -
Chromium-Molybdenum Steel; sand castings to specification. For liners and grates for ball mills.

- - 3 - 5 - - -
Nickel-Manganese Steel; Mn 13-15, C 0.7-0.9, Si 0.95-1.20, Ni 3.5-4.5; welding rod for building up and strength welding of austenitic manganese steel castings.

- - 3 4 - - - -
MCM; abrasion-resistant alloy sand castings to specification; C 1.00, Cr 2.00, Mo ½. Heat-treated: Ts, 140-190,000 psi; ys, 110-170,000 psi; elong in 2 in., 2-10 per cent; bhn, 300-400; magnetic; weldability, poor; abrasion resistance, high; max cont. serv. temp, 900 F. For ball mill liners, grates and similar parts subject to severe abrasion and moderate impact.

- - 3 - - - - -
Farmface; Cr-Mo-Ni-C-Si cast welding rods and electrodes. Hardness of 55-60 rockwell C on weld deposit; slightly magnetic; abrasion resistance, high; no heat treatment required. For hard-facing agricultural parts such as plow shares, scarifiers, cultivators, shoes, etc.

- - 3 - - 6 - -
No. 459; Mo-Cr-Ni-Mn-Si-C cast welding rods and electrodes. Hardness of weld deposit, 55-60 rockwell C; slightly magnetic; corrosion resistant to most acids; abrasion resistance, high; max cont. serv. temp, 800 F. For hard-facing machine parts subject to extreme abrasion and moderate impact.

1 2 - - - 6 - -
No. 217; W-Cr-Mo-C cast welding rods and electrodes. Hardness of weld deposit, 60-65 rockwell C; slightly magnetic; resists corrosion from most acids; abrasion resistance, high; max cont. serv. temp, 1000 F. For hard-facing machine parts subject to extreme abrasion at normal and elevated temperatures up to and including 1000 F.

1 - 3 4 - - - -
Toolface; High C-Cr-Mo-W-V welding rods and electrodes. Hardness of weld deposit, 55 rockwell C; magnetic; corrosion resistant to most acids; abrasion resistance, high; takes heat treatment similar to that employed for high-speed tool steel. For welding cutting tools, forging dies, rock drill bits, etc. Also for hard surfacing for extreme hardness and shock resistance.

- - 3 4 - - - -
Economy Hardface; welding rods and electrodes; high C-Cr-Mo: hardness of weld deposit, 45-50 rockwell C. Nonmagnetic; abrasion resistance, high. For hard-facing machine parts subject to extreme impact and abrasion.

Resistwear; welding electrodes; Cr-Mo-Mn-C; hardness of weld deposit, 45-50 rockwell C; magnetic; abrasion resistance, medium. For hard-facing parts subject to extreme wear.

1 2 3 4 5 6 7 8
ANACONDA—American Brass Co., Waterbury, Conn. Many copper base alloys, as well as pure copper in various forms under this tradename are available, some of which are listed below.

1 - - - - 6 - 8
Beryllium copper; Cu 97.50, Be 2.15, Ni 0.35; abrasion-resistant; high tensile strength and ductility. For springs, diaphragms, low-duty bushings and bearings.

- - - - - - - -
"85" Red Brass; Cu 85, Zn 15; pipe tube and sheet forms; particularly resistant to salt water corrosion.

1 2 - - - - - -
Super-Nickel; Cu 70, Ni 30; seamless tubes, sheets and plates. For severe condenser tube service and where resistance to salt water corrosion is desired.

- - - 4 - 6 - 8
Special Phosphor Bronze; Cu 88, Sn 4, Zn 4, Pb 4; corrosion, heat and abrasion-resistant; combines general characteristics of standard phosphor bronze alloys with free-cutting qualities of yellow brass.

See advertisements, Pages 297-298

- - 3 4 - - - -
ANCHOR Carbon-Vanadium — Anchor Drawn Steel Co., Latrobe, Pa. Drill rods for use where toughness is required, and where minimum machining is necessary. Hardens with fine-grained tough case, and resists breakage. For pins, bushings, etc.

- - - - - 6 - -
ANFRILOY—Wellman Bronze & Aluminum Co., Cleveland. A copper-lead-tin bearing bronze for high speed, light-duty bearings and for bushings where pressure and thrust are not excessive.

1 - - 4 5 - - -
ANTIMONIAL ADMIRALTY—Chase Brass & Copper Co., Waterbury 91, Conn. Cu 71, Sn 1, Sb 0.05, Zn 27.95. Outstanding for general corrosion resistance and particularly for preventing dezincification. Recommended for condensers in the power plant and oil industries.

1 - - 4 - - - -
APEX—Apex Smelting Co., Chicago 12. Aluminum, zinc and magnesium-base die casting alloys in slab, ingot, shot, and piglet form.

1 2 - 4 - 6 - -
APOLLO—Apollo Metal Works, Chicago 38.

- 2 - - - - - -
Chromsteel; cold-rolled strip, nickel-chrome-plated steel, furnished in sheets and strips, for stamping into parts. Resists heat to 800 F; abrasion resistance, medium; weldability, fair. Used generally as substitute for brass and copper sheet and other critical metals when resistance to corrosion is essential or reflectivity is needed.

1 - - 4 - 6 - -
Zinc steel; corrosion-resistant sheet or strip, zinc-plated to engineering specifications; for stamping and welding. Resists corrosion caused by salt water. Has high tensile strength, and is used for bearing applications.

- - - - - - - -
APOLLOY METAL—Apollo Steel Co., Apollo, Pa. C 0.06-0.10, Mn 0.30-0.60, S 0.45 max, P 0.04 max, Cu 0.20 min; in sheets; for stamping and welding into parts. Ts, 45-50,000 psi; ys, 25-30,000 psi; abrasion resistance, low; hardness, 40 to 50 rockwell B.

ARCOS Arc Welding Electrodes—Arcos Corp., Philadelphia 2, Pa. Stainless steel and alloy arc-welding electrodes for welding all types of metals.

1 2 3 4 5 6 7 8
ARISTOLOY—Copperweld Steel Co., Warren, Ohio. Full range of S.A.E. alloy steels, also aircraft, and special steels. Used for gears, both light and heavy-duty, clutches, shafts and pinions; also in ball and roller bearings and aircraft parts, both for engine and plane use; stainless and nitralloy steels. Also available are aircraft steels, stainless, nitralloy, bearing steels, and carbon and alloy tool steels. In its Glassport, Pa., plant the company produces copper-covered steel wire, strand and rods.

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ARMASTEEL—Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich. C 2.60, Si 1.40, Mn 0.4, S less than 0.15, P less than 0.1; fabricated into parts by sand casting. Recommended heat treatment to suit customer's requirements; ts, 100,000 psi; ys, 85 000 psi; elong, 8.0 per cent; bhn, 163-302; Rockwell "C" to 55 on hardening; sp gr, 7.2. For camshafts, rocker arms, diesel pistons, refrigerator parts, crankshafts, connecting rods, etc. also other automotive, diesel and hydramatic transmission parts.

1 2 - 4 5 - - 8
ARMCO Steels—The American Rolling Mill Co., Middletown, O.

Stainless steels in standard forms to AISI Specs. 301, 302, 303 304 308 309, 310, 316, 321, 347, 403, 405, 410, 414, 416, 420, 430, 430F, 431, 440A, 440B, 440C, 442, 446. For property and application data on these see "Stainless Steels" listing elsewhere in this section.

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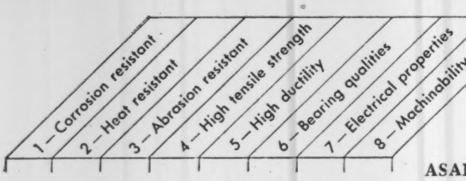
Tran-Cor 58; high silicon steel for distribution transformers. Grade 65: high silicon electrical steel sheets and strips with low core loss for power and distribution trans-



formers. Grade 72: a medium silicon steel for large generators and transformers.

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Tran-Cor X; medium-silicon electrical steel; furnished in straight and coiled strip and in sheet; annealed, ts is 60-65,000 psi; ys, 47-50,000 psi; elong in 2 in., 17-20 per cent; hardness, 75-79 rockwell B. For core laminations of power transformers.

Tran-Cor 52; high-silicon electrical steel; furnished in coiled and straight strip and in sheet; annealed, ts is 70-77,000 psi; ys, 61-65,000 psi; elong in 2 in., 2-4 per cent; hardness, 90-97 rockwell B. For distribution and power transformers where unusually low core loss is required.

Magnetic Ingot Iron; an open-hearth iron furnished in rough bars and billets, finished rods and bars, straight and coiled strip, sheet and plate. Annealed, ts is 45.000 psi; ys, 30,000 psi; elong in 2 in., 35 per cent; hardness, 40-45 rockwell B; magnetic; weldability, good. Primarily for cores of dc electrical equipment.

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High-Strength Steel 50Y; C 0.12 max, Mn 0.50-0.75, P 0.04-0.07, S 0.04 max, Si 0.10 max, Cu 0.50-0.70, Ni 0.60-0.90; furnished in cold-reduced sheet and strip. Annealed, ts is 65-80,000 psi; ys, 50.000 psi min; elong in 2 in., 20-32 per cent; hardness, 70-85 rockwell B; weldability, good; abrasion resistance, high. For load bearing members in various sheet metal structures.

High-Strength Steel 55Y; C 0.12 max, Mn 0.65-0.95, P 0.07-0.12, S 0.04 max, Si 0.10 max, Cu 0.50-0.70, Ni 0.60-0.90. Furnished in cold-reduced sheet and strip. Annealed, ts is 55-70 000 psi; ys, 55,000 psi; elong in 2 in., 15-27 per cent; hardness, 75-90 rockwell B; weldability, good; abrasion resistance, high. For load bearing members in various sheet metal structures.

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Galvanized Ingot Iron; an open-hearth iron furnished in straight and coiled strip and sheet. Annealed, ts is 45,000 psi; ys, 30.000 psi: elong in 2 in., 35 per cent; magnetic; weldability, fair; for general sheet metal applications.

Galvanized Steel; various medium and low-carbon analyses, copper-bearing steel in coiled and straight strip and sheet, magnetic; weldability, fair. For general sheet metal applications.

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Enameling Iron; an open-hearth iron furnished in straight and coiled strip and sheet; annealed, ts is 45.000 psi; ys, 30.000 psi; elong in 2 in., 35 per cent; hardness, 45 rockwell B; magnetic; weldability, good. For sheet metal parts to be porcelain enameled.

Intermediate Transformer; scale-free medium silicon steel sheet and strip for some transformer and special applications.

Special Electric; scale-free medium silicon steel sheet and strip. Annealed: Ts, 54-65,000 psi; ys. 40-50,000 psi; elong in 2 in., 19-23; hardness, rockwell B, 70-85. For ac motors and generators, radio power pack transformers, etc.

Electric; low-silicon electrical steel furnished in sheet and strip. Annealed: Ts, 48-60,000 psi; ys, 30-45,000 psi; elong in 2 in., 21-28; hardness, rockwell B, 60-80. For laminations in electric motors and generators.

Armature; steel sheet for small dc motors.

Field Grade; special sheet for intermittent duty fractional horsepower motors.

Radio No. 6; for applications in which superior low induction magnetic characteristics are important. No. 5; for audio transformer cores and other low induction applications. No. 4; good permeability at low induction; for chokes. Nos. 3, 2 and 1; for small transformers.

Ingot Iron; highly refined iron for magnetic cores; supplied in round and flat bar form.

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Armco Ingot Iron; highly refined iron supplied in galvanized sheet for general sheet metal work; also hot-rolled annealed and cold-rolled sheets, plates and strip.

Aluminized; a special aluminum-coated sheet (strip or coil) with exceptional resistance to heat and corrosion.

- 2 - 4 - 6 - -

ASARCOLOY No. 7—American Smelting & Refining Co., New York. A cadmium-nickel bearing alloy capable of withstanding high compression loads and high operating temperatures. Ni 1.3, balance Cd. Furnished in ingots for spinning and permanent-mold castings. Resists heat to 300 F; high abrasion resistance; ts, 15,000 psi; comp str, 20,000 psi; sp gr, 8.7; bearing properties, good; weldability, good. Used for bearings.

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ATHENIA Steel—The Athenia Steel Co., Division of National Standard Co., Clifton, N. J. Cold-rolled, high-carbon flat steels in widths of 1/16-in. to 6½ in.; thickness, 0.0015 to .062-in. Custom-made steels of 0.60 carbon and higher. Entire range of annealed, hard-rolled, black-tempered, tempered and polished or tempered and polished with blue or straw colored finish.

See advertisement, Page 138

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ATLAS No. 93—Allegheny Ludlum Steel Corp., Brackenridge, Pa. C 0.55, Cr 0.65, Mo 0.35. For collets, studs and parts requiring toughness in hardened condition. Oil hardening. For use as bucket teeth, keys, pins, bolts, studs, etc.

See advertisement, Page 313

1 - - 4 - 6 - -

AUROMET—Aurora Metal Co., Aurora, Ill. Special aluminum, bronzes, aluminum-nickel bronzes, and silicon bronzes of several compositions. In untreated state: Ts, 55-120,000 psi; ys, 25-85,000 psi; elong, 3-40 per cent; impact resistance, 30 ft-lb; hardness, 66-110 rockwell B; sp gr, 7.4; nonmagnetic; weldability, good; resist corrosion caused by weak acids and salt solutions; resist heat to 750 F; abrasion resistance, medium. For use as impellers, pump parts, bushings, worm gears, highly stressed structural parts, and vibration-dampeners.

1 2 3 - - - - -

AVIALITE—American Brass Co., Waterbury, Conn. Copper-aluminum alloy for valve seats and guides in airplane motors.

See advertisements, Pages 297-298

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"AW" (rolled steel floor plate)—Alan Wood Steel Co., Conshocken, Pa. Furnished in five patterns to meet flooring problems in the industrial and transportation fields; designed to withstand heaviest traffic; oilproof, crackproof, heatproof, slipproof, and noiseless. Furnished in carbon, copper or alloy analysis; also available in other non-ferrous metals.

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"AW" DYNALLOY—Alan Wood Steel Co., Conshohocken, Pa. Alloy steel furnished in rough bars, sheets, and plates for welding, cold forming, hot forming, stamping, etc. Abrasion resistance, high; ts, 70-80,000 psi; ys, 50,000 psi; elong in 2 in., 25 per cent; ductility, high; weldability, good; fatigue and impact values, high. For structures requiring high strength, such as machine bases.

B

1 2 - - - - - -

B & W CROLOY—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

1¼; C 0.15 max, Cr 1-1.5, Mo 0.45-0.65, Si 0.5-1; useful to 1100 F in steam, slightly higher in oil refining; has fair creep strength where limited corrosion and oxidation resistance are required.

2; C 0.15 max, Cr 1.75-2.25, Mo 0.45-0.65, Si 0.5 max; for refinery and superheater tubes. Corrosion and heat-resistant at nominal temperatures.

2¼; C 0.15 max, Cr 2-2.25, Mo 0.9-1.1, Si 0.5 max; for refinery and superheater tubes where high creep strength is required.

3M; C 0.15 max, Cr 2.75-3.25, Mo 0.8-1, Si 0.5 max; suitable from 1000 to 1050 F in steam or to 1175 F in refinery applications; good creep properties and corrosion resistance superior to Croloy 2 or 2¼.

5; chromium molybdenum; C 0.15 max, Cr 4-6, Mo 0.45-0.65; for oil refinery service.

7; C 0.15 max, Cr 6-8, Mo 0.45-0.65; for oil refinery service where increased corrosion resistance is required.

9; C 0.15 max, Cr 8-10, Mo 0.80-1.30 min; semistainless alloy of good physical properties and corrosion resistance.

Also stainless steel tubing furnished to AISI specs. 304, 310, 316, 317, 410, 430 and 446. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

See advertisement, Page 305

- - 3 4 - - - -

B & W 502—The Babcock & Wilcox Co., New York. High carbon alloy steel castings. In untreated state: Ts, 200,000 psi; bhn, 500-600; abrasion resistance, high. For grinding and crushing machinery.

1 2 - - - - 7 -

BAKER—Baker & Co. Inc., Newark 5, N. J. Platinum and alloys for linings, contacts, thermocouples, furnace resistors, etc.

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BEARITE—A. W. Cadman Mfg. Co., Pittsburgh. Babbitt metal furnished in ingots and 50-lb pigs; bhn at 70 F, 29.1; at 212 F, 24.4; comp str, 15,000 psi. For rotary bearings subjected to heavy loads and extreme speed.

1 - - - 5 6 - -

BEARIUM METALS—Bearium Metals Corp., Rochester, N. Y. High-lead bronzes with specially prepared metallurgical structure providing good frictional properties.

Grade B-4; Cu 70, Sn 4, Pb 26. Furnished in rough cored or solid bars, as sand castings, machined bushings, and in long lengths for screw-machine use. Ts, 21,000 psi; comp str, 9750 psi; bhn, 40. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. Used for bushings, bearings, packing, piston rings, and seals.

Grade B-10; Cu 70, Sn 10, Pb 20. Furnished in rough cored or solid bars, rough castings, machined bushings, screw-machine rod stock. Ts, 25,500 psi; comp str, 11,800 psi; bhn, 55. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. Good bearing properties. Used for bearings, bushings, packing and piston rings, seals, cross-head shoes, etc.

1 2 - 4 - - - -

No. 10; Be 0.60, Co 2.50, balance Cu. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Heat treated: Ts, 90-125,000 psi; ys, 50-60,000 psi; elong in 2 in., 10-15 per cent; hardness, rockwell B, 92-108; nonmagnetic; weldability, good; resists corrosion by atmosphere, and salt water; max cont. serv. temp, 750 F; abrasion resistance, medium. For parts requiring high electrical conductivity plus high strength, such as welding wheels, welding tips, bushings, circuit breaker contact parts, etc.

No. 70; Be 0.15, Cr 0.5, balance Cu. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, wire, sheet and plate. Heat-treated: Ts, 65-75,000 psi; ys, 35-45,000 psi; elong in 2 in., 15-20; hardness, rockwell B, 70-75; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 750 F; resists corrosion by atmosphere and salt water. For parts requiring high electrical conductivity plus high strength, such as welding wheels, electrode tips, bushings, etc.

See advertisement, Page 265

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ELECTRIC—Belle City Malleable Iron Co., Racine, Wis. Furnished as sand castings. Ts, 35-60,000 psi; high compressive strength; good bearing properties; recommended heat treatments are the same as for standard gray iron; bhn, untreated, 179-285; heat treated, 300-550. Used where rigidity, wearability, or where strong high grade gray iron might be applied.

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ELECTROMAL—Belle City Malleable Iron Co., Racine, Wis. High-strength malleable iron furnished as sand castings. Ts, 60-70,000 psi; high ductility; bhn, untreated, 140-170. Recommended for castings for automotive, railroad, tractor and implement work.

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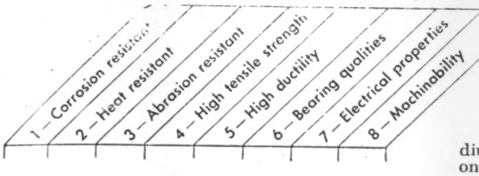
BELMALLOY—Belle City Malleable Iron Co., Racine, Wis. Pearlitic malleable iron, electric furnace melted and continuous-oven, annealed. Ts, 70,000 psi min; ys, 45,000 min; elong, 5 per cent min; bhn, 179-217. Used for castings of machining quality requiring strength and shock resistance.



1 - - 4 5 - - -
BENDIX Metal Hose—Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J. Corrugated seamless tubing with an analysis of various alloys. Used for exhausts, oil lines, vibration eliminators, etc.

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BERMAX BABBITT—Federal Mogul Corp., Detroit. A high lead babbitt; easy to use, cast and easy to handle in rebabbitting; melting point slightly higher than that of tin-base metals and can be cast by any method without fear of segregation. For bearing linings.

See advertisement, Page 299

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BERALOY "A"—Wilbur B. Driver Co., Newark, N. J. Beryllium-copper alloy; Cu 97.75, Be 2, and Co 0.25; furnished in soft annealed state or in slightly cold-worked conditions for easy machining and forming into parts. Ts, 66,000 psi in annealed state, can be increased to 175,000 psi by simple hardening treatment at 600 F, and by cold work after solution anneal, tensile strength can be increased to 200.000 psi. Used for electrical spring parts, contacts, switch jaws, diaphragms, switch parts, bearings, connectors, valves, cams, etc.

1 - - 4 - - 7 -
BERYLCO—Beryllium Corp., Reading, Pa. No. 25; Be 1.9-2.1, Co 0.15-0.25, balance Cu; furnished as rough bars or billets, finished rods or bars, strips, tubing and wire; for sand casting, die casting, turning, boring, forging, stamping and welding. In heat-treated state: Ts, 175-200.000 psi; ys, 146-179.000 psi; elong, 2-10 per cent; impact resistance, high; sp gr, 8.23 + or — 0.02; nonmagnetic; weldability, good. Resists corrosion caused by salt water and alkalies. Heat resistant to 450 F; abrasion resistance, high. Used for bushings, cams, worm gears, valve bodies, etc.

- 2 3 - - - - -
BESCOLOY Steel—Brighton Electric Steel Casting Co., Beaver Falls, Pa. Alloy steel, Ni 3, Cr 2; furnished in sand castings to specification. Heat treated, bhn is 340; magnetic; weldability, good.

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BETH-CU-LOY—Bethlehem Steel Co., Bethlehem, Pa. A copper-bearing-steel resistant to atmospheric corrosion. For packets, covers, machine guards, oil pans, etc.

See advertisement, Page 274

1 - 3 - - 6 7 -
BETHLEHEM—Bethlehem Steel Co., Bethlehem, Pa.

Substantially all standard carbon and alloy steels in standard forms.

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No. 235; abrasion-resistant, high-carbon-manganese-silicon steel of 235 brinell. For shovels, crushers, hoppers, scraper blades and conveyors.

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No. 88-80; Cr-Mo steel castings with high abrasion resistance. For ball mill liners, rolls, tires, bottom plates, etc.

- - - - - 6 - -
Bearing steels; standard high-carbon, high-chromium (52100 type) for ball bearings; and low-carbon nickel-molybdenum type for roller bearings. All grades can be processed to meet the requirements of automotive and industrial service.

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Magnet steels; high-carbon steels with varying chromium content up to 6 per cent.

See advertisement, Page 274

- - - 4 5 6 - -
BIAD Powder Metals—Biad Powder Metallurgy Co., Pittsburgh 6.

- - - - 5 6 - -
Grade 102; copper-zinc powder metal compound (Cu 70, Zn 30) furnished in pressed and sintered parts. Ts, 30,000 psi; ys, 20,000 psi; elong in 2 in., 30 per cent; bhn, 51; nonmagnetic; not weldable. Used in place of brass for small parts to reduce machining.

- - - 4 - 6 - -
Grade 105; copper-iron powder metal compound furnished in pressed and sintered parts. Ts, 60,000 psi; ys, 45,000 psi; elong in 2 in., 2 per cent; hardness, 75 rockwell H; slightly magnetic; weldability, fair. For parts of medium strength on which it is desired to save on machining.

- 2 3 - - 6 - -
BINNEY METAL—The Binney Castings Co., Toledo 7, O. Also known as Min-Ox. See listing under Min-Ox.

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BINNEY No. 71 and No. 73—The Binney Castings Co., Toledo 7, O. Heat-resisting alloy castings; weldability, good; heat-resistant to 2000 F; abrasion resistance, high. Used for construction parts for heat-treating furnaces and all applications requiring heat-resistant castings.

- - 3 4 - 6 - -
BLUE ANCHOR Drill Rod—Anchor Drawn Steel Co., Latrobe, Pa. C 1.25, Si 0.25, Mn 0.25. Water-quenched and tempered; hardness, rockwell C, 65-67; abrasion resistance, medium; max cont. serv. temp, 300-500 F. For shafts, dowel pins, punches, dies, gages, etc.

BOHNALITE—Bohn Aluminum & Brass Corp., Detroit. Light alloy of which aluminum is the base. For forged connecting rods, cast cylinder heads, crankcases, transmission cases, and parts for vacuum cleaners, washing machines, shoe machinery, etc.

See advertisement, Page 163

- - 3 - - - - -
BOROD—Stoody Co., Whittier, Calif. A rod made up of various screen sizes of irregularly shaped particles of tungsten carbide material —40-125 screen size—contained in steel tubes. Offers maximum resistance to abrasion; hardness 9-10 on Moh's scale; provides maximum wear resistance on earth drilling and scraping equipment; also excellent for hard-facing small or thin parts such as coal cutter bits and cane knives.

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BOUND BROOK—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Bushings, bearing and washers; cast bronze inlaid with hard graphite lubricant in grooves or holes of various designs; particularly adaptable to high temperatures, severe static loads, immersion in liquids, exposure to dusts or where oils are objectionable.

Graphited Bronze Bearings; Cu 81-85, Sn 6.25-7.5, Pb 6-8, Zn 2-4. Furnished in completed powder metal parts. Ts, 30,000 psi; ys, 14,000 psi; elong in 2 in., 12 per cent; max cont. serv. temp, 500 F. For oil-less bearings in all types of machines.

See advertisement, Page 284

1 - - - 5 - - -
BRASSOID—American Nickeloid Co., Peru, Ill. Brass bonded to zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and forming without marring prefinish.

1 - - - 5 - - -
BRIDGEPORT COPPER AND ZINC ALLOYS—Bridgeport Brass Co., Bridgeport, Conn.

Yellow brass; Cu 65, Zn 35; also Cu 70, Zn 30; sheet, wire and seamless tubing for drawing, stamping, and cold heading.

Cartridge brass; Cu 70, Zn 30. Sheet for making small arms ammunition and artillery cartridge cases.

Free-cutting brass rod; Cu 60, Pb 3, balance Zn. For making automatic screw machine parts.

Forging rod; Cu 60; Pb 2, balance Zn.

Low brass; Cu 80, Zn 20; pale golden color. For parts requiring greater ductility and malleability than possessed by yellow brass.

Commercial bronze; Cu 90, Zn 10; bronze color for manufacturing stampings and drawn items and cold headed items, for outdoor use. Stands weathering better than yellow brass; copper sheet, rod, wire, seamless tubing for miscellaneous manufacturing.

Leaded brass alloys; contain from 0.25-0.375 per cent Pb to facilitate machining.

Phosphor-bronze; Cu 92, Sn 8; for spring parts. Has better spring properties than lower tin content.

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Phosphor-bronze; Cu 95, Sn 5; sheet spring quality for manufacturing switch parts.

Copper in sheets and tubes for fabricating.

Bronze welding rods in a variety of alloys for brazing iron and steel gears, frames, and other broken machine parts; for welding silicon bronze tanks.

1 2 - - 5 - - -
BRIDGEPORT TUBING—Bridgeport Brass Co., Bridgeport, Conn.

Condenser tubing; available in Admiralty metal for sea water, Cuzinal (aluminum brass) for harbor water, Muntz metal for fresh water, Duronze IV for aerated brackish water, Cupro-Nickel for most severe service and U. S. Navy requirements, and Arsenical copper for resisting corrosion better than straight copper.

Duplex tubing; for two different types of corrosion inside and outside of tubing which are too severe for a single alloy. Steel, stainless steel, aluminum on outside or inside in combination with Admiralty brass, aluminum brass, copper or cupro nickel, used for oil refining refrigeration systems, chemical plants and food processing.

Copper water tubing; for industrial applications, and for pipe lines on board ship; also for air conditioning.

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BRONZOCHROM—Eutectic Welding Alloys Co., New York 13. For hard over-laying against frictional wear on ferrous and nonferrous metals. These rods have low bonding temperatures. Welds are hard and have low frictional coefficients. Can be applied in thin layers without distortion or stresses.

1 2 3 - - - - -
BUFFALO Wire Cloth—Buffalo Wire Works Co. Inc., Buffalo. Wire cloth for every industrial use. Screens for abrasive material, chemicals and powder in plain steel, tinned, brass, copper, bronze, Monel and stainless steel. Also galvanized after woven wire cloth.

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BUNDYFLEX Tubing—Everhot Products Co., Chicago 12. Copper fused and copper coated on both inside and out steel tubing which can be bent to any shape, hard or soft soldered, brazed or welded and used for many purposes for which ordinary copper tubing was previously required. Strong and has high resistance to vibration fatigue. Used on passenger cars and trucks as fuel lines, oil filter lines, hydraulic brake lines, etc., also on oil burners, refrigerators, farm tractors, airplanes, etc.

1 2 3 4 5 6 7 8
BUNDYWELD Tubing—Bundy Tubing Co., Detroit, Mich.

Steel Tubing; of SAE 1010 steel, in sizes ⅛-⅝ OD in wall thicknesses from 0.020 to 0.049-in.

Monel Tubing; in sizes ⅛ to ⅝-in. OD.

"L" Nickel Tubing; in sizes ⅛ to ⅝-in. OD.

"A" Nickel Tubing; in sizes ⅛ to ⅝-in. OD.

See advertisement, Page 140

1 - - - - 6 - 8
BUNTING—Bearing Bronzes—The Bunting Brass & Bronze Co., Toledo, O. Precision-machine cored and solid bar stock. Over 1000 sizes of standardized fully-finished stock bearings for machinery applications. All cast in accordance with bearing bronze specification SAE 660 (QQB-691, Grade 12). Special sizes made to blueprint from SAE, AMS, ASTM, Federal, Navy and Air corps specifications and from the company's recognized standard bronze bearing alloys, vis:

No. 72 (SAE 60); Cu 83, Sn 7, Pb 7 and Zn 3. General-purpose bearing bronze.

No. 27; Cu 80, Sn 10 and Bb 10. General-purpose bearing bronze.

No. 96; Cu 87.5, Sn 10 and Pb 2.5. For severe service, heavy pressures.

No. 98; Cu 88, Sn 10 and Zn 2. Hard bronze for severe service and heavy pressures. An allowance of 1 per cent lead content improves machinability and bearing characteristics without impairing the physicals. Used in aviation engines.

No. 124; Cu 85, Sn 5, Pb 9 and Zn 1. Excellent in automotive camshaft and piston pin applications.

No. 125; Cu 75, Sn 5 and Pb 20. Good antifriction properties.

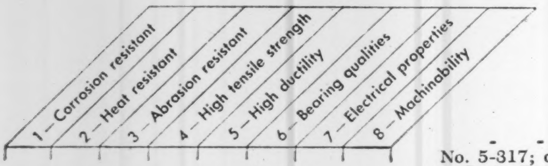
No. 164; Cu 86, Sn 11, Pb 1.5 and Ni 1.5. Gears and synchronizer rings.

No. 178; Cu 68, Sn 4 and Pb 28. Main and connecting rod applications.

No. 170; Pb 75, Sn 10 and Sb 15; babbitt metal.

No. 116; Sn 86, Cu 7 and Sb 7; genuine babbitt metal.

Aviation and machine tool bearings and trans-



mission cones are sand, chilled or centrifugally cast and machined to the utmost precision dimensions and surface finishes.

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BYERS Genuine Wrought Iron—A. M. Byers Co., Pittsburgh 30. Two-component metal of high purity iron and iron silicate; furnished in rough bars or billets, finished rods or bars, tubing, sheets, plate and pipe for forging, welding, turning, boring, etc. Recommended heat treatment: after severe fabrication, heat to about 1300-1400 F and allow to cool slowly. Ts, 40,000 psi; ys, 24,000 psi; elong in 8 in. (min), 14 per cent; bhn, 97-105; rockwell B, 55-60; sp gr, 7.70; magnetic; good weldability. Resists corrosion caused by various chemical and electro-chemical reactions; abrasion resistance, high. For any part where resistance to corrosion and/or fatigue is essential.

The company also produces other standard alloys and stainless steels of both open hearth and electric furnace grades.

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1 2 - - - - - -

CALITE Heat-Resisting Cast Steels—Calorizing Co., Pittsburgh.

"A"; A Ni-Cr alloy (Ni 35, Cr 16); good creep strength; useful at temperatures up to 2000 F; bhn (as cast), 200. For hearth plates, enameling supports, chain, and general mechanical parts in furnaces, Also available in rolled bar stock.

"B"; for constant-high-temperature applications up to 1800 F.

"B-28"; for furnace parts operating at temperatures up to 1950 F.

"BL"; similar to "B", with less strength at high temperatures but better machinability, increased ductility and shock resistance.

"B-29"; for furnace parts operating at temperatures up to 2050 F.

"N"; available in sheets, bars and castings. For parts operating at temperatures up to 2100 F, particularly parts subject to uneven heating or rapid, irregular temperature changes.

"E"; available in bars and sheets for parts subject to temperatures up to 1600 F.

"E-28"; available in bars and sheets for parts subject to temperatures up to 1950 F.

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CAMBRIDGE—Cambridge Wire Cloth Co., Cambridge, Md. A wire cloth used for conveyor belts in processing, mechanical. food, glass, ceramic and metalworking fields.

See advertisement, Page 275

1 2 3 - - - - -

CARBOLOY—Carboloy Co. Inc., Detroit. A series of cemented carbides basically made from tungsten carbide and a softer cementing element such as cobalt. In certain grades, supplementary ingredients are the carbides of tantalum, titanium or other metals. Has high resistance to abrasive and corrosive wear; outstanding on account of its extreme hardness, compressive strength being as high as 800,000 psi. Rockwell hardness on "A" scale 86-93. Does not rust or corrode under normal conditions. Recommended as wear-resistant inserts for machine parts subject to extreme wear such as cams, cam followers, valve stems, etc.

See advertisement, Page 278

1 2 3 4 5 6 7 -

CARPENTER—The Carpenter Steel Co., Reading, Pa.

1 2 - 4 - - - 8

Stainless Steels; in standard forms to AISI Specs. 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 406, 410, 414, 416, 420, 420 F, 431, 440 A,B,C,F, 430, 430 F, 442, 443, 446, 501 and 502. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

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Presto; C 1.05, Cr 1.4; for ball and roller bearings.

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Silico-manganese steel: C 0.6, Mn 0.75, Si 2. For heavy-duty springs.

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No. 5-317; chrome-nickel steel; C 0.5, Ni 1.75, Cr 1. For gears, clutches and shafts.

No. 5 Samson; C 0.5, Ni 1.25, Cr 0.6. For gears and clutches.

No. 4-408; C 0.4, Ni 3, Cr 0.75. For clutches and shafts.

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No. 158; C 0.1, Ni 3.5, Cr 1.5. For case-hardened high-duty clash gears, shafts and clutch parts.

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No. 2 Samson; C 0.2, Ni 1.25, Cr 0.6. For case-hardened gears, roller bearings, pneumatic tool parts, etc.

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No. 4 Samson steel; C 0.4, Ni 1.25, Cr 0.6. For side links of silent chains, shafts, etc.

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No. 3-547; nickel-steel; C 0.3, Ni 3.5. For heat-treated shafts, etc.

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No. 2-547; case-hardening nickel-steel; C 0.2, Ni 3.5. For small parts requiring hard surface and tough core.

No. 500; C 0.1, Ni 5. For turbine blades, case-hardened gears, etc.

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Chrome-vanadium 5-720; C 5, Cr 0.9, V 0.2. For leaf and coil springs, gears, shafts, etc.

No. 3-247; chrome-molybdenum-steel; C 0.3, Cr 1, Mo 0.2. For aircraft and automotive parts.

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No. 436; C 0.15, Ni 1.75, Mo 0.25. For case-hardened parts.

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Temperature compensator alloy; iron-nickel alloy; furnished in rough bars or billets, finished rods or bars, wire and strips for hot forging, stamping, turning, boring, etc.; permeability varies inversely as temperature. For magnetic shunts for meters, speedometers, tachometers, voltage regulators, etc.

See advertisements, Pages 154-155, 286

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CARTRIDGE BRASS—Revere Copper & Brass Inc., New York 17. Cu 70, Ni 30; furnished in straight and coiled strip; for hot and cold working, stamping, drawing, and arc, gas and resistance welding. In cold-worked state: ts, 84,000 psi; ys, 65,000 psi; elong in 2 in., 5 per cent; hardness, 85 rockwell B; sp gr, 8.53; max cont. serv. temp, 500 F. For drawn parts and stampings, pins, rivets, eyelets, electrical sockets, etc.

See advertisements, Pages 263-264

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CASTOLIN—Eutectic Welding Alloys Co., New York 13. "Low temperature" welding rods bond without melting base metals. High strength color match, less stresses, less warping and preheating. Welds all metals. All standard methods of heating employed (gas, arc, furnace and others).

CERROBASE—Cerro de Pasco Copper Corp., New York. Bismuth-lead casting alloy which expands on cooling; melts at 255 F; ts, 6100 psi. Recommended for autoclaves, liquid seal for nitriding furnaces, electroforming, etc.

CERROBEND—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-cadmium casting alloy which expands on cooling and has the extremely low melting temperature of 160 F; ts, 6000 psi. Useful as a fusible alloy and as a filler for tube bending.

CERROMATRIX—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-antimony casting alloy which melts at 248 F and expands on cooling; ts 13,000 psi. Used for locating and anchoring machine parts in cored holes.

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CHACE—W. M. Chace Co., Detroit 9.

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Thermostatic bimetal; a number of combinations including alloys of nickel-iron, nickel-iron-chromium, nickel-iron-manganese, pure nickel, brass, bronze, etc.; responsive to various temperature ranges and provide a wide range of deflection rates and electrical resistivities. For temperature control elements in controllers, recorders, indicators, etc.

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No. 772 manganese alloy; Mn 72, Cu 18, and Ni 10; furnished in finished rods or bars, coiled strips and sheets; for turning, boring and stamping. Mechanical properties in untreated state: Ts, 120,000 psi; ys, 90,000 psi; elong, 12 per cent; impact resistance, high; bhn, 200; weight, .26 lb per cu in.; nonmagnetic; weldability, fair; heat-resistant to 500 F. Used where low thermal conductivity, high electrical resistivity and high thermal expansion are required.

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CHAMET BRONZE—Chase Brass & Copper Co., Waterbury 91, Conn.

Type A; Cu 60, Sn 0.75, Zn 39.25. For shafting and structural and engineering uses.

Type B; Cu 62.25, Sn 0.65, Zn 37.10. For general cold heading and upsetting purposes.

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CHASE—Chase Brass & Copper Co., Waterbury 91, Conn.

Cupro-Nickel; Cu 70, Ni 30; largely used for condenser tubes, particularly for extreme service in very corrosive waters.

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Leaded commerical bronze; Cu 89, Pb 2, Zn 9; for screw machine parts requiring good physical properties and high corrosion resistance.

Also various high and low brasses and bronzes in various forms to meet specific requirements for a variety of mechanical parts.

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CHASE Tellurium Aluminum Bronze—Chase Brass & Copper Co., Waterbury 91, Conn. Cu 88.75, Al 9.75, Fe 1.0, and Te 0.5, furnished in finished rods or bars for forging, turning, boring, etc. As extruded, ts, 85,000 psi, ys, 33,000 psi, elong, in 2 in., 30 per cent; rockwell B hardness, 76; sp gr, 7.59. Light drawn, ts, 95 000 psi; ys, 60,000 psi; elong in 2 in., 15 per cent.

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CHASE TELLURIUM COPPER—Chase Brass & Copper Co., Waterbury 91, Conn. Cu 99.5, Te .5; furnished in finished rods or bars and tubing for hot forging, extruding, turning, boring, etc.; corrosion resistant; resists heat to 450 F; medium abrasion resistance; ts, 32-55 000 psi; medium ductility; bhn, untreated, 90. For electrical connections, parts for electric motors, switches, etc.

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CHROMALOID—American Nickeloid Co., Peru, Ill. Chromium bonded to nickel-bonded zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quickly removable, gum-adhered paper covering, permitting drawing and forming without marring pre-finish.

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CHROMAX—Driver-Harris Co., Harrison, N. J. A heat-resisting alloy used for carburizing containers or furnace parts; Ni 35, Cr 19, and balance Fe.

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CHROMEL—Hoskins Mfg. Co., Detroit.

Alloy 502; Ni 35, Cr 18½, balance mainly Fe; supplied as castings, or as rod, bars, and strips. For general heat-resistant applications and for mechanical and load-carrying members.

Alloy 670; Cr 25, Ni 12, balance mainly Fe; supplied as castings or as rod, bars and strips. For high-temperature applications where sulphur corrosion must be withstood.

Grade A; Ni 80, Cr 20; supplied as castings or as rod, bars, wire and strip. Used for electric heating elements to 2100 F.

Grade C; Ni 60, Cr 16, balance mainly Fe. Used for electric heating elements to 1800 F; also for rheostatic purposes: supplied as castings, or as rods, bars and strip.

Grade D; Ni 35, Cr 18½, balance mainly Fe. Used for heating elements to 1600 F; available cast, or as wire, rod and strip, and welding wire. For mechanical purposes where heat resistance or load-carrying ability while hot are of importance.

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CIMET—Driver-Harris Co., Harrison, N. J. Ni 10-12, Cr 26-28, and balance Fe. Castings for furnace parts in high sulphur atmospheres, and for acid resisting castings in pump impellers, piping, etc.

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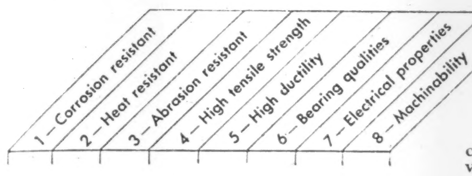
CIRCLE L—Lebanon Steel Foundry, Lebanon, Pa. This tradename covers forty-eight different types of alloys and Emergency Steels including the following:



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No. A; C 0.40, Si 0.40, Mn 0.70. Ts, 92,000 psi; ys, 50,000 psi; elong, 23 per cent; bhn, 180. Used for high-strength structural castings. Also available in three other grades with slightly varying analyses.

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No. 7; C 0.03, Si 0.50, Mn 0.05. Ts, 50,000 psi; ys. 27,000 psi; elong, 35 per cent; bhn, 120. For electrical equipment and for parts requiring high magnetic permeability.

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No. 9; C 0.20, Si 0.40, Mn 0.65, and Mo 0.50. Ts, 70,000 psi; ys, 45,000 psi; elong, 30 per cent; bhn, 140. For turbine parts, valves and fittings, etc., and for pressure castings at temperatures to 900 F. Excellent resistance to creep.

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No. 10; C 0.20, Si 0.40, Mn 0.65, Cr 5.5, and Mo 0.50. Ts, 100,000 psi; ys, 70,000 psi; elong, 19 per cent; bhn, 200. For valves, fittings and pressure castings for oil refineries, etc. Combined resistance to creep and moderately resistant to corrosion. For temperatures up to 1100 F.

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No. 11; C 0.25, Si 0.75, Mn 0.75, Cr 19, and Ni 1.5 max. Ts, 100.000 psi; ys, 75,000 psi; elong. 8 per cent; bhn, 200. For chemical apparatus. This stainless steel is capable of hardening by suitable heat treatment.

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No. 15; C 0.30. Si 0.75, Mn 0.75, Cr 28, and Ni 1.50. Ts, 60,000 psi; ys. 35 000 psi; elong, 3 per cent; bhn, 190. For heat and corrosion resistance requirements.

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No. 19; C 0.15, Si 0.40, Mn 0.65, and Ni 2.75. Ts, 80.000 psi; ys. 54 000 psi; elong, 27 per cent; bhn. 165. Good impact resistance at low temperatures.

No. 21: columbium-stabilized stainless steel; C 0.07. Si 1 25. Mn 0.75. Cr 19.50, Ni 9 00, columbium 0.75. Ts, 75.000 psi; ys, 36,000 psi; elong. 42.5 per cent; bhn. 145. For valves, pumps and parts requiring welding in chemical and process industries.

No. 22; low-carbon stainless steel for general corrosion resistance. commonly known as KA2S: C 0 07, Si 1.25, Mn 0.75, Cr 19.5, and Ni 9.00. Ts. 75.000 psi; ys. 36,000 psi; elong. 55 per cent; bhn. 135. For general chemical and process equipment.

No. 23: C 0.15. Si 1 25. Mn 0.75. Cr 19.5, and Ni 9.00. Ts, 75,000 psi; ys, 36,000 psi; elong. 50 per cent: bhn, 140. Miscellaneous stainless castings for generally moderate corrosive applications in chemical and process plant equipment.

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No. 30: C 0.15, Si 1.25, Mn 0.75, Cr 24.5, and Ni 11. Ts, 85 000 psi; ys, 50.000 psi; elong, 35 per cent· bhn, 165. A higher grade of stainless steel for heat and corrosion resistant requirements in chemical and process plant equipment.

No. 31: C 0.25. Si 1.25, Mn 0.75. Cr 28.5, and Ni 9.5. Ts. 83 000 psi; ys, 47.000 psi; elong, 15 per cent; bhn, 155. For equipment where resistance to severe acid and mine waters, and sulphur atmospheres at high temperatures (as high as 2000 F) is required.

No. 32; C 0.35, Si 1.25, Mn 0.75, Cr 15, and Ni 35: heat-resistant alloy; good strength at high temperatures. Ts, 70 000 psi; ys, 45,000 psi; elong, 12; bhn, 150. For furnace parts and certain process plant equipment.

No. 33; C 0.07. Si 3.25, Mn 0.75, Cr 19.5, Ni 23.5, Mo 2 50, and Cu 1.75. Ts, 75 000 psi; ys, 35.000 psi; elong, 45; bhn, 150. For parts subject to sulphuric acid corrosion and dilute hydrochloric acid at room temperatures.

No. 41; nickel-chrome, heat-resistant alloy; C 0.35. Si 0.125. Mn 0.50, Cr 16.5, and Ni 66.5. Ts, 80,000 psi; ys, 35,000 psi; elong. 15 per cent: bhn, 160. For parts at elevated temperatures.

No. 43: C 0 35. Si 1.25, Mn 0.50, Cr 18.5, and Ni 38.5. Ts, 72.000 psi; ys. 47 000 psi; elong, 15 per cent; bhn, 170. For parts subjected to elevated temperatures.

No. 46; special heat and corrosion-resistant alloy, suitable for weldments. C 0.15, Si 0.75. Mn 0.75, Cr 24, and Ni 18.5. Ts, 70,000 psi; ys, 30,000 psi; elong, 45 per cent; bhn, 130. For parts subjected to elevated temperatures.

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No. 106; C 0.17, Si 0.40, Mn 1.3, and Mo 0.25. Ts, 125,000 psi; ys, 90,000 psi; elong, 10 per cent; bhn, 260. For carburized steel parts requiring tough core and hard surface.

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No. 205A; C 0.30, Si 0.40, Mn 0.80, Cr 0.60, Ni 0.60, and Mo 0.20. Ts, 95,000 psi; ys, 62,000 psi; elong, 23 per cent; bhn, 180. For railway car castings, automotive and airplane parts, crankshafts, cams, gears, etc.

See advertisement, Page 294

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CLETALOY—Cleveland Tungsten Inc., Cleveland. Copper-tungsten type electrodes for spotwelding. Available in four grades with high specific gravity.

CT-A; predominantly tungsten; hardness of 92-97 rockwell B with an electrical conductivity about 38 per cent that of pure copper. In addition to spot-welding, it works well as crimper die insert for finish turning edge of steel jacket to form a seal for the porcelain stem in spark plugs.

CT-65; conductivity and tungsten similar to that of CT-A grade; hardness of 84-91 rockwell B. For welding of thin stainless steel sheets, and in the upsetting of special steel which does not forge well, this grade supplies red hot surface which can withstand high pressure of small bar during knob-forming process. This grade holds original hardness especially well.

CT-86; has a higher electrical conductivity than other grades with a rockwell B hardness of 77-83. Suitable for welding nonferrous metals and for applications where low pressures are sufficient.

LN-14; silver-tungsten-base alloy for use in applications where it shows an advantage over copper, possibly having some connection with the fact that silver oxide which might form on surface is a better electrical conductor than copper oxide.

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CLEVE-TUNG Molybdenum—Cleveland Tungsten Inc., Cleveland. Mo 99.9 plus. Furnished in rough bars or billets, finished rods and bars, wire, sheet, plate, and powder metal. In cold-worked state; Ts, from 50,000 to 250.000 psi; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont. serv. temp, 3000 F (protected atmosphere). For various electronic parts, etc.

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CLEVE-TUNGSTEN—Cleveland Tungsten Inc., Cleveland. Tungsten rough bars or billets, finished rods and bars, wire, sheet, plate, and powder metal. For power tube parts. Hardness, rockwell C, 40-48; sp gr, 19.3; nonmagnetic; weldability, poor; resists acids and alkalies; max cont. serv. temp (protected atmosphere) 4500 F; abrasion resistance, high.

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CLEVEITE—Cleveland Graphite Bronze Co., Cleveland. Copper-lead strip used for bearing purposes. Also complete bushings for automotive and general machine use.

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COLDWELD—Eutectic Welding Alloys Co., New York 13. Cast-iron welding rods and electrodes. Bonds on all ferrous and nonferrous metals except aluminum. For delicate castings where high temperatures must be avoided, such as water jackets. cylinders, compressors, crank and gear cases, etc.

1 2 3 4 5 6 7 8

COMMERCIAL—Commercial Steel Castings Co., Marion, O. Steel castings to special specifications and to ASTM. Army or Navy, American Bureau of Shipping and Maritime Commission Specifications.

COLOMONOY—Wall Colmonoy Corp., Detroit.

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No. 1; Cr 7-11, B 1-2, Si 2-4 and Fe balance. Welding electrode with rockwell C hardness of 58-62; sp gr, 7.70; weldability, fair. For hard-facing various parts of high manganese steel such as dipper teeth, scraper blades, etc., agricultural equipment.

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No. 4; Ni 75-85. Cr 8-14, B, Fe, Si and C 8 max. Cast welding rod; hardness, rockwell C, 35-40; sp gr, 8.22; nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp. 1500 F; abrasion resistance, medium.

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No. 5; Ni 71-81, Cr 10-17, B, Fe, Si and C 9 max. Cast welding rod; hardness, rockwell C, 45-50; sp gr, 8.14; nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp, 1500 F; abrasion resistance, high. For parts subject to wear and corrosion, but which must be hard-faced with a machinable alloy, such as sleeves, auto and diesel valves, steam valves, pump sleeves, pump plungers, etc.

No. 5 Special; Ni 74-77, Cr 17-19 and B 3.5-4.5. Cast welding rod; hardness, rockwell C, 47-52; sp gr, 8.02; nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp, 1500 F. For hard-facing and overlaying auto and diesel valves, aircraft engine valves, steam valve trim, etc.

No. 6; Ni 71-81, Cr 10-17, and B, Fe, Si and C 9 max. Cast welding rod (powder metal or plastic rod). Hardness, rockwell C, 56-62; sp gr, 7.80; nonmagnetic; weldability, excellent; resists corrosion caused by all alkalies and acids except hydrochloric; max cont. serv. temp, 1500 F; abrasion resistance, high. For shaft sleeves and plungers, steam valve trim, centers, centerless grinder rests, cams, gages, sprockets, seal rings, etc.

No. 9; Cr 7-11, B 1-2, Mo 12-16 and Fe balance. Cast welding rods. Hardness, rockwell C, 64-67; sp gr, 7.93; nonmagnetic; weldability, good; abrasion resistance, very high. For centers, centerless grinder rests,

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No. 20; Ni 80-90, Cr 5-9, B 1-2, Fe, Si and C 7 max. Cast welding rods. Hardness, rockwell C, 15-20; sp gr, 8.34; nonmagnetic; weldability, good; resists corrosion caused by all acids except hydrochloric and all alkalies; max cont. serv. temp, 1500 F; abrasion resistance, medium.

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No. WCR 100; Cr 13-19, B 2.75-4, W 17-22, and Fe balance. Furnished in finished rods or basis for gas welding. Hardness, rockwell C, 65-68; sp gr, 8.40; nonmagnetic; weldability, good; abrasion resistance, high.

Sweat-on Paste; for gas welding and carbon arcing. Parts hard-faced with paste may be heat-treated without harm to overlay. Hardness, rockwell C, 68-72; sp gr, 3.30; abrasion resistance, high. For tractor grousers and sprockets, coal chutes, fan blades, sand scraper blades and other foundry equipment subject to severe wear such as dipper teeth, bucket lips, etc.

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COLONIAL—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. Two types, both available in rough bars or billets. finished rods or bars, wire, sheet, plate, forgings and drill rods.

Type 14; C 1.00. Si 0.25, Mn 0.25. In heat-treated state: hardness, rockwell C, 65-67; abrasion resistance, low.

Type 17; C 1.00, Si 0.25, Mn 0.25, and V 0.20. In heat-treated state: hardness, rockwell C, 65-67; max cont. serv. temp, 300-500 F; abrasion resistance, medium; good bearing qualities.

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COLORSTRIP—Acme Steel Co., Chicago 8. Strip steel, electro-galvanized or plain and coated on one or both sides with any specific color (coating may be either enamel or lacquer); furnished in coils and can be fabricated by rolling or stamping; corrosion-resistant; resists heat to 150 F; same tensile strength, elongation and hardness as standard strip steel with slight variations depending on temper and analysis of the base metal.

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COLUMBIA—Columbia Steel & Shafting Co., Pittsburgh 30. Furnished in bars. Tensile strength is high; bearing properties, good; material machines freely.

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COMMERCIAL—Buckeye Brass & Mfg. Co., Cleveland. Cored and solid bronze bars; Cu 80 Sn 10, Pb 10. For bushings, bearings, etc.

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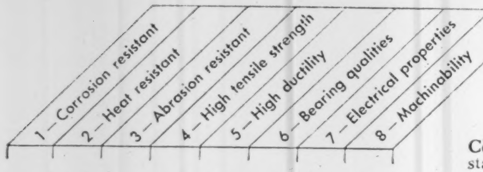
COMPO—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

165-R-2; Porous bronze bearings and washers containing higher percentage of graphite; Cu 87, Sn 9.5, graphite 3.5. Porous structure contains to 15 per cent oil developed particularly for antiscuffing under heavy vibrating static loads; also heavy oscillating loads. Ts, 15,000 psi; comp str, 75,000 psi.

F; Oil-retaining porous bronze bearings; Cu 85, Sn 9.5, Graphite 5.5. Furnished in



completed powder metal parts. For seals, seal rings, seal thrust washers in pumps, compressors, etc.

63-H-2; Oil-retaining porous bronze bearings; Cu 89, Sn 9.75, Graphite 1.25. Furnished in completed powder metal parts. Ts, 12,000 psi; hardness, 25-50 rockwell H. For oilless bearings in all types of machines.

66-H-2; oil-retaining porous bronze bearings; Cu 80, Sn 9.75, Graphite 1.25. Furnished in completed parts via powder metallurgy. Ts, 14,700 psi, hardness, 30-70 rockwell H. For oil-less bearings in machines.

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CONDULOY Beryllium Copper—The Brush Beryllium Co., Cleveland. Be 0.35, Ni 1.5, Cu balance. Furnished in form of rough bars or billets. Heat-treated: Ts is 85-100,000 psi; ys, 70-80,000 psi; elong in 2 in., 4-13 per cent; hardness, 90-100 rockwell B; nonmagnetic; weldability, fair; max cont. serv. temp, 700-800 F; resists corrosion about same as pure copper. For resistance welding electrodes, welding wheels, circuit breakers, etc., and brake drums.

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Beryllium Copper Alloy No. 6; Be 2.5, Ni 1.1, Cu balance. Furnished in form of rough bars or billets. Heat treated: Ts is 150-180,000 psi; ys, 110-140,000 psi; elong in 2 in., 1-3 per cent; hardness, 38-44 rockwell C; nonmagnetic; weldability, fair; abrasion resistance, high; resists corrosion about same as pure copper; max cont. serv. temp, 400-500 F. For bearings, bushings, and high-strength, high-hardness parts in general.

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CONPERNIK—Westinghouse Electric Corp., East Pittsburgh, Pa. An iron-nickel alloy; Ni 49.5, Fe 49.5 and Mn 0.1. Has constant permeability over limited ranges of flux variations; electromagnetic; available in strip, punchings and finished cores, continuous cold-rolled strip and hot-rolled sheets. For use wherever a high ratio of reactance to resistance is required.

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CONTINENTAL Alloy Steels — Continental Foundry & Machine Co., East Chicago, Ind.

C-1; furnished in seven grades ranging from 0.20-0.80 carbon content; plain carbon steels.

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C-2; C-Mn-Ni-Mo cast steel for parts requiring special physical properties such as tractor frames, locomotive castings, power shovel castings, locomotive crane castings, and other machinery parts.

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C-3; C-Mn-Mo cast steel requiring special properties such as sprockets, spindles, gears, miscellaneous castings for power shovels, locomotive cranes locomotive wheel centers and crossheads, and other parts.

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C-4; C-Mn-Mo-V cast steel for pinions, axles and spindles, and other parts subject to severe service.

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C-5; C-Ni-Mo cast steel for forging machinery and hammer parts, rams and sow blocks.

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C-6; C-high Cr-Mo cast steel for special abrasive qualities suitable for various types mills, crushers, etc.

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C-7; C-Cr-Ni-Mo cast steel designed for machinery or other parts subjected to severe wear, strength and impact service.

C-10; C-Cr-Mo cast steel for forging dies, tools, etc. All of the above steels are heat-treated to give desired properties.

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"Chrome-Molybdenum"; Cr-Mo alloyed steel rolling mill rolls for blooming, bar, billet, structural and merchant mills; also backing-up rolls for strip mills.

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"Heat-Treated Alloy"; Cr-Ni-Mo rolling mill rolls for billet, blooming, merchant and bar mills.

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Special; Ni-Cr alloyed steel for rolling mill rolls for use in billet, bar, structural and merchant mills where resistance to wear is prime factor.

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COOPER ALLOYS—The Cooper Alloy Foundry Co., Hillsdale, N. J. Numerous castings of stainless steel, Monel, nickel, chrome-iron, chrome-nickel and other special alloys, for various applications.

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COPEL—Hoskins Mfg. Co., Detroit. Cu 55, Ni 45. Used mostly for electrical resistance purposes, also for heating elements to 800 F. Temperature coefficient of resistance is practically nil.

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COPPERWELD—Copperweld Steel Co., Glassport, Pa. Copper-covered steel in steel wire or rod, with copper exterior permanently welded (cast) to the steel core; resists rust and corrosion; provides adequate electrical conductivity for many electrical uses and rust-resisting high strength for many mechanical uses. In its Warren, O. plant the company also produces aircraft steels, stainless steels, Nit.alloy steels, bearing steels, and carbon and alloy tool steels.

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CRAMP ALLOYS—Cramp Brass & Iron Foundries Division, Baldwin Locomotive Works, Philadelphia.

No. 49; furnished in rough bars or billets, rods or bars, and sand castings. Resists heat to 400 F; high abrasion resistance; ts, 120,000 psi; comp str, 55,000; medium ductility; sp gr, 6.8; good bearing properties. Used for heavy-duty, slow-moving loads.

No. 99; furnished in rough bars or billets and rods or bars. Resists corrosion by sulphuric, sulphurous, acetic acids; heat-resistant to 450 F; high abrasion resistance; ts, 55,000 psi; comp str, 22,000; good bearing properties; bhn, untreated, 100. Used for high-speed bearings and acid-resisting parts.

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CRASFLOY—Continental Foundry & Machine Co., East Chicago, Ind. Hard alloy grain iron rolling mill rolls made in four grades: mild, medium, hard and super hard for rolling hot and cold strip, sheets and plate.

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CROMANSIL—Metal & Thermit Corp., New York 5. Arc welding electrode for main drive shafts, automotive springs, jib crane parts, etc. Weld deposit: Ts, 77-114,000 psi; ys, 65-102,000 psi; elong in 2 in., 14-26 per cent.

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CROMONITE—Continental Foundry & Machine Co., East Chicago, Ind. Hard alloy chill roll made in four grades: mild, medium, hard and super hard for hot and cold strip rolling.

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CUMBERLAND—Cumberland Steel Co., Cumberland, Md.

Turned and ground steel rods and bars made to AISI Specs C 1022, C 1040 and C 1137. For precision shafting, studs, tie rods, etc.

JS-1; magnesium alloy (Al 4.8, Zn 0.9, Mn 0.2, Mg balance) furnished in straight strip, sheet, plate and ingots. Untreated: Ts, 47,000 psi; ys, 34,000 psi; elong in 2 in., 9 per cent; hardness, rockwell E, 83; nonmagnetic; sp gr, 1.79; weldability, good; corrosion resistant to alkalies, chromates, fluorides, arsenates, pure chromic and hydrofluoric acids, various organic compounds, weathering; abrasion resistance, medium; max cont. serv. temp, 400 F. For parts requiring light weight plus moderate strength, such as reciprocating or fast-moving parts. Machinability of this alloy is excellent.

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CUNICO—General Electric Co., Schenectady, N. Y. Permanent-magnet alloy of copper, nickel and cobalt, made from rod, strip or wire stock, furnished in finished shapes, age-hardened. Malleable, ductile and machinable, permitting manufacture of small magnet screws and punching of intricate shapes.

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CUNIFE—General Electric Co., Schenectady, N. Y. Permanent-magnet copper-nickel-iron alloy. Magnets made of wire stock in round, square or rectangular form. Wire can be flattened to make thin, narrow shapes. Wide variety of magnet designs can be obtained by forming, drawing, punching, or machining.

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CUPALOY—Westinghouse Electric Corp., East Pittsburgh, Pa. Copper-base alloy containing chromium and silver; thermal and electrical conductivity, 80-90 per cent of pure copper; tensile properties of steel; bhn 140-160. Applications include spot-welding tips, seam-welding wheels and rolls, mechanical parts carrying heavy current etc. Licensee: A. W. Cadman Mfg. Co., Pittsburgh.

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CUPRODIE—A. Finkl & Sons Co., Chicago. A 0.50 carbon, chromium, nickel, molybdenum, copper for die blocks, inserts and bars; furnished heat-treated to various tempers, all commercially machinable to 477 bhn. For drop hammer dies and inserts, also forging machine dies.

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CUPRON—Wilbur B. Driver Co., Newark, N. J. Cu 55, Ni 45; in rough bars or billets, finished rods or bars, wire and coiled strips. In untreated state: Ts, 62,000 psi; per cent elong, hard, 2-soft 40; sp gr, 8.9; nonmagnetic; weldability, good; heat-resistant to 1500 F. For electrical uses.

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CUPRO-NICKEL, 30 per cent—Revere Copper & Brass Inc., New York 17. Cu 70, Ni 30; furnished as finished rods or bars, tubing, sheets, strips (coiled) and plates; for fabricating into parts by stamping, extruding, welding, deep drawing or cold forging. Resists heat to 500 F; abrasion resistance, medium; ts, 50-90,000 psi; ductility, high; sp gr, 8.95. For marine condenser tubes and condenser plate, cold-headed bolts etc.

See advertisements, Pages 263-264

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DAIRYWHITE—Arthur Harris & Co., Chicago 7. Copper-nickel alloy, Cu 67, Ni 23, balance, Zn, Pb and tin. For food machines, dairy machines, etc.

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DAMASCITE—Chrysler Corp., Amplex Div., Detroit. 31. A ferrous, nonporous high-density material used for machine parts of irregular shapes; ts, 80,000 psi; readily machined; heat-treatable; high magnetic properties.

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DEFENDER Babbitt—Magnolia Metal Co., Elizabeth, N. J. Lead-base, less than 10 per cent of tin; recommended for shock loads. Bhn, 21.8.

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DELLOY METALS—Delloy Metals, Philadelphia 33. Cast alloys of Cr, Co, and W. Mechanical properties: Ts, 54,000 psi; comp str, 325,000 psi. For bearing applications.

No. 6; Co 43, Cr 33.4, W 19.1, C 2.7 and other alloying elements 1.8. Hardness, rockwell C, 62-64.

No. 9; Co 47.9, Cr 31.0, W 17.2, C 2.0, and other alloying elements 1.9.

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DEWARD—Allegheny Ludlum Steel Corp., Brackenridge, Pa. C 0.9, Mn 1.5, Mo 0.3. For holders for thread chasers and gang punches. Oil hardening.

See advertisement, Page 313

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D-H-S BRONZE—Koppers Co. Inc., Bartlett Hayward Div., Baltimore. In rough bars, billets, rods or bars, also as sand castings: Zn 21-25, Cu 61-65, hardener (Al, Mn and Fe) 13-15. Resists corrosion; heat-resistant to 400 F; high abrasion resistance; ts, 100-130,000 psi; comp str, 90,000 psi; elastic limit, 40,000-65,000 psi; elong in 2 in., 20-11 per cent; nonmagnetic; bhn, untreated, 200-240. For heavy-duty bearings, gears, guides, screws, stems, nuts, etc.

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The company also offers a special D-H-S Bronze (analysis confidential); furnished in rough bars or billets, finished rods or bars and plates, and as sand and centrifugal castings. Ts, 100-130,000 psi; comp str, 65-90,000 psi; ys 50-75,000 psi; elong, 10-18 per cent; impact resistance, high; bhn, 195-240; nonmagnetic; heat-resistant to 400 F; abrasion resistance high. For slow-speed bearings, high pressure parts, etc.

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing qualities
7—Electrical properties
8—Machinability

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DIAMOND ALLOY—Pettibone Mulliken Corp., Chicago 51. Cr 23-30, iron cast alloy. Ts, 60,000 psi min; bhn, 500 min; magnetic; abrasion resistance, high. For dredge pump and abrasive handling pump parts, grinding and crushing rolls, etc.

- 2 - 4 - - - -
DM-45—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. C 0.4-0.5, Mn 0.4-0.7, Si 0.5-0.8, Cr 1-1.5, Mo 0.45-0.65; furnished in rough bars or billets, and finished rods or bars; for hot forging, turning, boring, etc., into parts. Resists heat to 1100 F; ts, 150,000 psi, min, heat-treated; medium ductility; bhn, untreated, 185; heat-treated, 411 max. For bolts, studs and other highly-stressed parts used at elevated temperatures.

See advertisement, Page 273

1 2 - - - - - -
DM STEEL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. C 0.15 max, Mn 0.3-0.6, Si 0.5-1, Cr 1-1.5, Mo 0.45-0.65, P .03 max, S .03 max; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Resists heat to 1100 F; ts, 60,000 psi min; medium ductility; fair weldability; bhn, annealed, 163 max. Used in oil refinery field.

See advertisement, Fage 273

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DODGE Steel Castings—Dodge Steel Co., Tacony, Philadelphia.

Medium-Carbon Steel (SAE 1030); furnished in heat-treated sand castings. Ts, 70,000 psi; ys, 35,000 psi; elong in 2 in., 24 per cent; bhn, 143 min; magnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 850 F. For machine parts subject to moderately high loads and impact; valves and fittings for steam, liquids and various gases; structural members, etc.

D-1 Manganese-Molybdenum Steel; furnished in heat-treated sand castings. Ts, 80-170,000 psi; ys, 55-140,000 psi; elong in 2 in., 22-7.5 per cent; bhn, 163-360; magnetic; weldability, fair (good when preheated); abrasion resistance, good (when fully hardened). For high-strength machine parts and those requiring wear resistance, and flame or induction hardening.

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D-12 Low Carbon-Nickel Steel; furnished in heat treated castings. Ts, 70,000 psi; ys, 40,000 psi; bhn, 143; magnetic; weldability, good; abrasion resistance, medium; excellent low-temperature properties (15 ft-lb Charpy at —75 F). For structural and machine parts subject to impact loads, at normal and low temperatures.

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DOLER-ALUMIN—Doehler Jarvis Corp., New York. Aluminum base die castings. Composition suited to meet stringent requirements such as high tensile strength, impact strength, hardness, corrosion resistance, thermal conductivity and electrical conductivity.

1 2 - 4 - - - -
DOLER-BRASS—Doehler Jarvis Corp., New York. Brass die castings. Composition suited to meet varying conditions. Ts, to 100,000 psi, and bhn, to 180; excellent corrosion resisting properties.

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DOLER-MAG—Doehler Jarvis Corp., New York. Magnesium base die castings made from the lightest of the commercial metals; one-third lighter than aluminum.

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DOLER-ZINK—Doehler Jarvis Corp., New York. Zinc base die castings of maximum tensile and impact strength.

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DOWMETAL—The Dow Chemical Co., Midland, Mich. Magnesium alloy ingots, castings, wrought forms, rods, bars, sheet, shapes, extrusions, sand and die castings; also forgings, magnesium metal ingots and magnesium metal sticks. Available in various types:

C; Al 9, Mn 0.1, Zn 2, remainder Mg; in ingots for sand casting. Ts, 40,000 psi; comp str, 60,000; ys, 16,000; elong, 10 per cent; impact resistance, high; high elastic resilience; sp gr, 1.82; nonmagnetic; resists corrosion caused by caustic chromic acid, hydrofluoric atmospheres, etc. Used for reciprocating parts and housings.

FS-1; Al 3, Mn 0.3, Zn 1, remainder Mg; in rough bars or billets, finished rods or bars, tubing, sheets, coiled strips, plates; for extruding, rolling, drawing and pressing. Ts, 40,000 psi; ys, 30,000; comp str, 50,000; elong, 16 per cent; endurance limit (completely reversed bending), 14,500 psi; sp gr, 1.77; nonmagnetic; high elastic resiliency. Used for aircraft parts and other applications requiring light weight.

H; Al 6, Mn 0.2, Zn 3, remainder Mg; in ingots for sand casting. Ts, 40,000 psi; ys, 14,000; comp str, 46,000; elong, 12 per cent; impact resistance, high; high elastic resilience; sp gr, 1.83; resists corrosion caused by caustic, chromic acid, hydrofluoric atmospheres, etc. Used for aircraft parts and other applications requiring light weight.

J-I; Al 6.5, Mn 0.2, Zn 1, remainder Mg; in rough bars or billets, finished rods or bars, tubing, sheets, coiled strips, plates; for hot forging, extruding, rolling, drawing and pressing. Ts, 45,000 psi; ys, 32,000; comp str, 69,000; elong, 15 per cent; endurance limit (completely reversed bending), 18,000 psi; sp gr, 1.8; nonmagnetic; high elastic resilience. For structural parts and fabricated housings.

M; Mn 1.5, remainder Mg; in the same form as for sand casting, hot forging, rolling, drawing and pressing. In rolled state: Ts, 37,000 psi; ys, 29,000; elong, 8 per cent; impact resistance, high; sp gr, 1.76; nonmagnetic; weldability, good; heat-resistant to 400 F; high elastic resiliency. For parts requiring best formability of magnesium alloys.

O-1; Al 8.5, Mn 0.2, Zn 0.5, remainder Mg; in rough bars or billets, finished rods or bars and tubing; for hot forging and extruding. In heat treated state: Ts, 50,000 psi; ys, 34,000; comp str, 75,000; elong, 5 per cent; impact resistance, high; endurance limit (completely reversed bending), 16,000 psi; sp gr, 1.8; nonmagnetic; high elastic resiliency. For structural parts requiring maximum strength.

R; Al 9, Mn 0.2, Zn 0.6, remainder Mg; in ingots for die casting. Mechanical properties in untreated state; Ts, 33,000 psi; ys, 22,000; elong, 3 per cent; impact resistance, high; sp gr, 1.74; abrasion resistance, medium; nonmagnetic. For housings and structural parts.

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DRIVER-HARRIS—Driver-Harris Co., Harrison, N. J.

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No. 42 alloy; notable for its coefficient of linear expansion—approximately that of different grades of glass.

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No. 52; alloy of nickel and iron has been successfully used for sealing in glass in which process no coating is required prior to the operation.

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DUNKIRK EZ—Allegheny Ludlum Steel Corp., Brackenridge, Pa. Silicon manganese steel furnished in rough bars, finished bars and rods, straight and coiled strip, and wire. Ts (heat treated), 189,000 psi; ys, 168,000 psi; elong in 2 in., 10 per cent; bhn, 375; max cont. serv. temp, 300-500 F; weldability, good. Used as a free-machining tool steel. For parts such as feed fingers. spindles, bushings, arbors, gibs, etc.

See advertisement, Page 313

1 2 - 4 5 6 - -
DURALOY—The Duraloy Co., Scottdale, Pa.

- 2 - 4 - 6 - -
C; C 0.15 max, Cr 11-14, Si 1 max, Mn 1 max; cast chrome steel furnished in cast tubing. Heat treated: Ts, 110,000 psi; ys, 90,000 psi; elong in 2 in., 23 per cent; bhn, 228; magnetic; weldability, good; abrasion resistance, low; max cont. serv. temp, 1250 F; resistant to furnace atmospheres. For furnace parts, glass rolls, and parts requiring oxidation or scale resistance.

1 2 - 4 - - - -
N; C 0.35, Cr 25, Ni 12; cast chrome-nickel steel furnished in cast tubing. Ts, 80,000 psi; ys, 45,000 psi; elong in 2 in., 10 per cent; bhn, 225; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 2000 F. For heat treating equipment such as boxes, trays, chains, skids, doors, etc.

18-8; C 0.07-0.20, Cr 18-20, Ni 8-10, Si 1 max, Mn 2 max. Chrome-nickel cast steel furnished in cast tubes. Heat-treated: Ts, 70,000 psi, min; ys, 30,000 psi, min; elong in 2 in., 50 per cent, min; bhn, 180; nonmagnetic; weldability, good; abrasion resistance, low. For equipment in chemical, paper and textile industries.

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DURASPUN—Duraloy Co., Scottdale, Pa., Centrifugal castings including tubing with a wide range in wall thicknesses, and odd shapes such as materials conveyor screws.

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DURCO—Duriron Co. Inc., Dayton, O. Alloy steels (KA2S, KA2SMo, etc.): 18 Cr, 8 Ni, C max 0.07, and other standard as well as special analyses preferred by users. For pumps, valves, fittings, castings for corrosive service, etc.

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DUREX—Moraine Products Div., General Motors Corp., Dayton, O. Products of powder metallurgy in iron, bronze and other metals; self-lubricating bearings and various small parts for electric motors, instruments, aircraft, appliances, automotive equipment, farm equipment, washing machines, etc.

See advertisement, Page 151

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DURFACE—Eutectic Welding Alloys Co., New York 13. Wear-resistant alloy welding rod (gas and arc) for building up on steel, manganese steel and cast iron.

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DURICHLOR—Duriron Co. Inc., Dayton, O. Si 14.5, Mo 3, C 0.90, Mn 1, traces of P and S, balance Fe. For pumps, valves, pipe, castings for corrosive service, especially for hydrochloric acid and chloride solutions.

1 2 - - - - - -
DURIMET—Duriron Co. Inc., Dayton, O.

T; Ni 22, Cr 19, Si 1, Mo 3, Cu 0.07 max, C 0.07 max, balance Fe. For pumps, valves, bolts, nuts and castings for corrosive service, especially weak sulphuric acid.

20; Ni 29, Cr 19, Si 1, Cu 3, Mo 2, C 0.07 max, balance Fe. For pumps, valves and castings only for corrosive service, especially hot, weak sulphuric acid of strengths higher than recommended for Durimet T.

1 - 3 - - - - -
DURIRON—Duriron Co. Inc., Dayton, O., and licensees. Si 14.50, C 0.8, Mn 0.6, S and P traces, balance Fe. For pumps, valves, exhaust fans, mixing nozzles and castings for handling acids and other corrosive liquids and gases.

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DURODI—A. Finkl & Sons Co., Chicago. A 0.50 carbon, furnished in inserts, bars and shaped pieces; heat-treated to various tempers, all commercially machinable; also annealed for hardening in oil or in air blast. For forging machine dies, inserts and mandrels and forging dies.

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DURO-GLOSS—Jessop Steel Co., Washington, Pa. Standard stainless steels in following grades: Type 410, 430, 442 and 446. For property and application data, see "Stainless Steels" listings elsewhere in this section.

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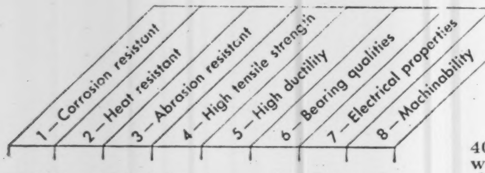
DURONZE ALLOYS — Bridgeport Brass Co., Bridgeport, Conn. High Cu-Si bronzes alloyed with elements such as Sn, Fe, Al, etc. Possess high strength combined with corrosion resistance.

I; possesses excellent cold working properties; for making cold-headed bolts and screws, average 100,000 psi ts, in rod, wire and sheet form.

II; hot-rolled sheet for making range boilers, automatic heaters and storage tanks by either electric-arc or oxyacetylene welding methods; cold-rolled strip used as a substitute for phosphor bronze spring metal; rod and wire used for making hot-headed bolts and screw products; supplied in sheet, rod, wire, and ingot forms.

III; supplied in rod form only; ts, from 85,000-100,000 psi; hot forgings 90,000 psi; free-machining for making screw machine parts, also for sucker rods for corrosive oil wells; ten per cent lighter than brass; excellent corrosion resistance. In ingot form may be used for making sand castings with ts about



70,000 psi. Used for compression fittings for oil and gas lines in airplane construction, small gears, screws, pinions, etc.

IV; made into condenser tubes only; for resisting corrosion from aerated sea water mixed with fresh water and acid wastes, sewage, etc., often found in harbors. Also for hot brine solutions in salt refining.

V; wire for making difficult cold-headed parts, screws, bolts, rod, sheet. Malleable; good corrosion resistance; ts, about 100,000 psi. Recommended for cold-headed bolts and outdoor use. Also tubing for hydraulic lines on aircraft.

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DUTCH BOY BABBITT—National Lead Co., New York 6. Analysis of the material varies according to the bearing application.

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DYNALLOY—Alan Wood Steel Co., Conshohocken, Pa. Alloy steel furnished in sheets, strips, and plates, for stamping, welding, cold and hot forming, etc.; abrasion resistance, medium; ts, 70-80,000 psi; ductility, high; weldability, good; fatigue and impact values, high. For structures requiring high strength.

E

1 2 - - 5 - - -

ES—Eastern Stainless Steel Corp., Baltimore 3, Md. Stainless steel sheets made to AISI Specs. 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 410, 420, 430, 442, and 446. For property and application data, see "Stainless Steels" listing elsewhere in this section.

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EASY-FLO—Handy & Harman, New York 7. Brazing alloy; flows at 1175 F; Ag 50, Cu 15.5, Zn 16.5, Cd 18. Resists corrosion due to silver content; sp gr, 9.49. For brazing ferrous and nonferrous metals, particularly dissimilar metals and Monel metal, stainless steel and other copper-nickel and chrome-nickel alloys. Has many electrical uses. Also Easy-Flo No. 3 for fabrication of large copper piping, etc.

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ECLIPSE Seamless Flexible Metal Hose—Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J. Bronze 85/15, or 3 per cent silicon, steel, aluminum, silver and various other alloys. Tubing resists corrosion caused by salt water ammonia, steam, gases, etc. Has high ductility.

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ECONOMO—Wheelock Lovejoy & Co., Inc., Cambridge, Mass. Carbon 0.2 and 0.5 with alloy of molybdenum; free machining; for machine tool parts.

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EIS 45—Heppenstall Co., Pittsburgh. C 0.85, Cr 12. Furnished for hot forging into parts. Used for shear blades for shearing medium heavy material.

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EIS 57—Heppenstall Co., Pittsburgh. Nickel-chrome-molybdenum-steel, 0.6 carbon; for insert and hot die steel service.

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ELASTUF—Horace T. Potts Co., Philadelphia 34

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Type A-2; heat-treated and stress relieved. Special chrome-vanadium with small controlled amounts of nickel and molybdenum; hot rolled. Further heat treating after machining not recommended. Ts (up to 2 in.), 125-145,000 psi; ys, 115-135,000 psi; elong in 2 in., 18-22 per cent; reduction of area, 52-62 per cent. Heat-treated alloy steel with high physical properties in machinable conditions; uniform hardness and strength throughout cross-sections of all sizes; good heat and wear resistance.

Type 44; heat-treated and stress relieved. Special analysis including chrome-nickel and molybdenum; hot rolled. Ts (up to 2 in.), 190-220,000 psi; ys, 175-200 000 psi; elong in 2 in., 10-17 per cent; reduction of area, 40-50 per cent. Machinable at 42-46 rockwell C. Has high tensile properties in machinable condition.

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Type JJ Soft Steel; Hot-rolled; C 0.15-0.25 (an improved analysis soft steel); furnished in bars. Carburize 1650-1700 F, cool in box, reheat to 1400-1450 F, quench in water, draw to 250-500 F. In untreated state: Ts, (up to 2 in.), 60-70,000 psi; ys, 35-45,000 psi; elong in 2 in., 25-35 per cent; reduction of area, 50-60 per cent; weldability, good. Recommended for all soft steel uses; excellent for forging, welding, bending.

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ELASTUF CHRO-MOLY (Heat Treated)—Horace T. Potts Co., Philadelphia 34. Heat-treated alloy steel of good tensile properties, high impact strength and shock resistance, excellent creep characteristics. Ts (up to 2 in.), 130-150 000 psi; ys, 110-125 000 psi; elong in 2 in., 18-22; reduction in area, 50-60 per cent. For use as axles heavy-duty, high temperature and high pressure bolts, etc.

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ELASTUF MEDIA—Horace T. Potts Co., Philadelphia 34.

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Precision Finish; Analysis same as AISI C-1040 and SAE 1040; furnished in finished bars (turned ground and polished). Normalize at 1650-1700 F, cool in air, heat to 1500-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 90-105 000 psi; ys 75-90,000 psi; elong in 2 in., 10-20 per cent; reduction of area 35-50 per cent; good weldability and machinability. For use where accuracy to size and straightness is needed.

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Hot-Rolled; Analysis same as AISI C-1045 and SAE 1045; furnished in hot-rolled bars. Normalize at 1650-1700 F, cool in air, heat to 1500-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 80-95 000 psi; ys, 45-60,000 psi; elong in 2 in., 15-25 per cent; reduction of area 30-45 per cent; good weldability and machinability, and high tensile strength.

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ELASTUF PENN—Horace T. Potts Co., Philadelphia 34.

Hot-Rolled; Approx. 0.45 carbon, special analysis. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 100-125,000 psi; ys, 60-75 000 psi; elong in 2 in., 15-25 per cent; reduction of area, 30-45 per cent: weldability, good; machining qualities, good.

Cold-Finished; Approx. 0.45 carbon, special analysis. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 2 in.), 110-135,000 psi; ys, 100-115 000 psi; elong in 2 in., 12-22 per cent; reduction of area, 35-50 per cent; weldability, good; same quality as Hot-Rolled with better machinability and higher tensile properties in cold drawn sizes (up to 3 in dia.).

Strainfree Cold-Finished; Approx. 0.45 carbon, special analysis. Furnished in finished bars. Normalize at 1650-1700 F, cool in air, heat to 1525-1550 F, quench in water, draw to desired hardness. Ts (up to 1 in.), 125-145,000 psi; ys, 110-120,000 psi; elong in 2 in., 10-20 per cent; reduction of area, 30-45 per cent; weldability, good; specially processed to give tensile properties equal to many heat-treated alloy steels. Free from warping in machining. For lead and feed screws and miscellaneous machine parts.

ELECTROMET — Electro Metallurgical Sales Corp., New York 17. A complete line of ferro-alloys and alloying elements of various analyses.

See advertisement, Page 139

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ELECTRUNITE—Steel and Tubes Division, Republic Steel Corp., Cleveland 8. Electric welded tubing in stainless, carbon and various alloy steels. Square, rectangular, oval, or other shapes, in any size or gage where the periphery of the shape is not less than 2-1/32 in. or more than 16 in. Furnished in following analyses: SAE 1010-1035, NE-8630, X-4130 and in stainless steel types 302, 302-B, 304 309, 316, 317, 321, 347 and 446. Used for general mechanical, structural, aircraft, conduit, boiler, condenser, heat exchanger and other pressure applications. (For "Stainless Steel" listings, see list appearing elsewhere in this section)

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ELEPHANT BRAND Phosphor Bronze — The Phosphor Bronze Smelting Co., Philadelphia. Furnished in wire, sheets, rods and castings.

Sheets in rolls, slit sheet metal, tinned both sides; in various gages and tempers covering a broad range of uses.

Wire in coils for springs, flat wire, in coils or lengths; tinned binding for armature work, binding wire (round), dead soft to any temper required, straightened (round), in lengths.

Rods in complete range of sizes from rounds 0.010-4¾ in., hexagons ⅛-2¼ in., and squares ¼-2¼ in. Also in many rectangular and special shapes. For parts subject to corrosion, fatigue, wear, shock and abrasion.

Castings; special alloys for bearings, gears, valves, etc. Also 214 stock bushings sizes carried in stock.

See advertisement, Page 312

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ELKALOY—P. R. Mallory & Co. Inc., Indianapolis. A work-hardened alloy of copper, not heat-treatable, for spot and seam welding aluminum and its alloys, unpickled hot-rolled steel, terne plate, tin plate, galvanized iron and other materials. A direct substitute for copper, it handles the same but is harder and lasts longer.

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ELKONITE—P. R. Mallory & Co. Inc., Indianapolis. Three definite classes of materials.

One group based on copper and such refractory metals as tungsten, molybdenum and their carbides—combinations which produce material with good electrical conductivity and great wear-resistant qualities, for use as welding electrodes and contactors in oil immersed circuit breakers. Certain of these grades are heat treatable. The heat treatment improves electrical and physical properties.

Second group based on silver and refractory material such as tungsten, molybdenum, and their carbides, and has been developed primarily as a facing material for heavy-duty electrical contacts and contactors for air breakers.

Third group comprises basically silver in which is incorporated refractory material such as cadmium oxide or nickel. These materials are used as heavy contacts, particularly for aircraft relays, and contact facings and main contacts on heavy-duty breakers.

All three groups can be used in the form of thin facings or as inserts with copper or copper alloy backing materials, having high electrical conductivity coupled with high physical properties.

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ELKONIUM—P. R. Mallory & Co. Inc., Indianapolis. A series of electrical contact materials divided into the following groups: Silver, platinum, palladium and gold-base alloys. These groups are designed to cover a wide range of applications and can be supplied in a wide variety of forms.

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ELVERITE—Babcock & Wilcox Co., New York. Sand-cast and chill-cast wear irons for tube mill liners, roll heads, jaw crushers and special applications.

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ENDURO—Alloy Steel Div., Republic Steel Corp., Massillon, O. Standard stainless steels of AISI Types 302, 302-B, 303, 304, 309, 310, 316, 321, 347, 403, 410, 414, 416, 430, 430-F, 446. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

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ERMAL—(Z-Metal)—Erie Malleable Iron Co., Erie, Pa. A spheroidized pearlitic-malleable iron; for castings requiring rigidity, high tensile strength, and abrasion resistance. Suitable for heat treatment.

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ERMALITE—Erie Malleable Iron Co., Erie, Pa. Wear-resisting alloy iron; for wearing plates, friction drums and other parts subject to high stresses or wear.

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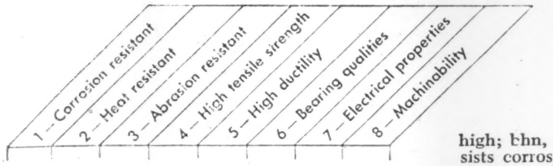
EVANSTEEL—Chicago Steel Foundry Co., Chicago. Ni 1-1.5, Cr 0.65-1, C varies from 0.3-0.5, sometimes carries additions of V or Mo. For castings such as passenger car knuckles, tooth bases, sprockets gears, high pressure valves, etc. In general, for parts requiring high tensile strength plus good shock and abrasion resistance.



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EVERDUR—American Brass Co., Waterbury, Conn.

Alloy No. 1010; Cu 95.8, Si 3.1, Mn 1.1. Uses include welded tanks and sewage disposal apparatus.

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Alloy No. 1012; Cu 95.60, Si 3.00, Mn 1.00, Pb 0.40; made in rod only for automatic screw machine production.

Alloy No. 1014; Cu 91.00, Si 2.00, Al 7.00; made in rods only for automatic screw machine production and hot forging.

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Alloy No. 1015; Cu 98.25, Si 1.5, Mn 0.25; easily fabricated by all methods including welding. Used for tubes, bolts and screws.

Alloy No. 1000; casting alloy; Cu 94.9, Mn 1.1, Si 4.

See advertisements, Pages 297-298

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EXCELSIOR—Alloy Metal Wire Co. Inc., Prospect Park, Pa. Electrical resistance alloy round and flat wire and rod. Ni 45, Cu 55. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation.

This company also handles nickel, Grades A, D and E Monel, "R" Monel, "K" Monel, "KR" Monel, "Z" Nickel and Inconel. For property and application data on these, see listings under material name.

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FAHRALLOY—The Fahralloy Co., Harvey, Ill. High nickel-chrome, depending on analysis; furnished as castings; heat-resistant to 2100 F. Used for furnace parts, quenching fixtures, carburizing pots, etc.

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FAHRITE—The Ohio Steel Foundry Co., Springfield, Ohio. Various grades of corrosion, heat and abrasion resisting alloys, some of which are:

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N-1; C 0.4-0.6, Cr 15-18, Ni 34-38; in rods, bars and sand castings. Resists oxidation to 2000 F; has high strength and ability to withstand thermal shock at high temperatures; good weldability; ts, 70,000 psi; sp gr, 7.94; bhn, as cast, 165-185. For chain links, retorts and furnace parts.

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N-3; C 0.3-0.5; Ni 10-13; Cr 24-27; in rods, bars, sand castings and centrifugal tubes. Resists oxidation to 2000 F and corrosive attack in sulphur atmosphere; has high strength at elevated temperatures; good weldability; ts, 90,000 psi; elong, 20 per cent; sp gr, 7.73; bhn, as cast, 165-175. For tube supports, baffles, dampers, etc.

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N-61; C 0.4-0.75, Ni 59-63, Cr 10-15; in sand castings. Resists oxidation to 2000 F; good weldability; ts, 70,000 psi; sp gr, 8.13; bhn, as cast, 175-185. For carburizing furnace parts.

C-28; C 0.35 max, Ni 3 max, Cr 25-30; in sand castings. Resists oxidation to 2100 F; has low high-temperature strength; highly resistant to sulphur gas atmosphere; poor weldability; ts 90,000 psi; elong, 18 per cent; sp gr, 7.6; bhn, 150-200. For use where resistance to high temperature in sulphur gas atmosphere is required.

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FALLS—Falls Hollow Staybolt Co., Cuyahoga Falls, O. C 0.016, P 0.099, Si 0.114, Mn 0.33, S 0.018; furnished in rough bars or billets for machining. In untreated state: Ts, 48-52,000 psi; elong in 8 in., 30 per cent; weldability very good; machinability, good. For staybolts in locomotive type boilers.

1 2 - 4 5 - 7 -

FANSTEEL—Fansteel Metallurgical Corp., North Chicago, Ill.

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Molybdenum; Mo 99.9+; in finished rods or bars, wire, sheets, strips and powder metal; for stamping, turning, boring, welding into parts. Ts, 260,000 psi; impact resistance, high; bhn, 147; sp gr, 10.2; nonmagnetic; resists corrosion caused by most acids; heat-resistant to 3000 F in protective atmosphere; abrasion resistance, medium. Used for critical electrical parts.

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Tantalum; Ta 99.9+; in finished rods or bars, tubing, wire, sheets and strips; for stamping, turning, boring, welding, etc. Ts, 42-178,000 psi; impact resistance, medium; bhn, 75-125; sp gr, 16.6; nonmagnetic; weldability, good. For corrosion-resisting parts.

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Tungsten; W 99.95 per cent; furnished in rough bars or billets, finished rods or bars, wire, sheets, shapes, powder metal and ribbon, for forming, fabricating and powder metallurgy. Mechanical properties in untreated state: Ts, 490,000 psi; impact resistance, high; bhn, 290; sp gr, 19.3; magnetic; resists corrosion caused by most acids; abrasion resistance, high.

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FARRELL—Farrell-Cheek Steel Co., Sandusky, O.

Hard Edge; alloy steel, carbon penetrated, furnished as sand castings; high abrasion resistance; high tensile strength and ductility; bhn, heat-treated, 650-700 and higher. For crane wheels, conveyor and elevator chains, sprockets, elevator buckets, etc.

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Regular Carbon; C 0.20-0.30, Si 0.30-0.45, and Mn 0.60-0.75; furnished as sand castings. In heat-treated annealed state: Ts, 72,000 psi; ys, 44,000 psi; elong in 2 in., 28 per cent; bhn, 140; magnetic; machinability, good. For those parts requiring high ductility, medium strength and good machinability.

No. 0.25 carbon steel; furnished as centrifugal castings; in annealed state.

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No. 0.40 carbon steel; C 0.35-0.45, Si 0.30-0.45, Mn 0.70-0.80; furnished as sand castings. In heat-treated state: Ts, 115,000 psi; ys, 84,000 psi; elong in 2 in., 18 per cent; magnetic; weldability, good; abrasion resistance, medium. For parts requiring medium high tensile strength and good abrasion resistance.

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No. 85; specially processed steel castings for resisting abrasion. In heat-treated state: Ts, 111,500 psi; ys, 93,000 psi; elong in 2 in., 20 per cent; bhn, 235; magnetic; weldability, good; abrasion resistance, high. For parts requiring high tensile strength and ductility.

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FEDERAL BRONZES — Federal-Mogul Corp., Detroit.

F1; a gear bronze suitable for heavily loaded piston pin bushings, etc.

F2; lead bronze for average bushings application.

F3; used largely as backs for babbitt-lined bearings.

F5; widely used for babbitt-lined bearing backs and for bushings where service is not severe.

F8; good casting and machining qualities.

F11; for piston pin bushings and other low speed, heavily loaded applications.

F15; has 20 per cent lead and may be used safely under adverse lubrication conditions.

F16; because of high lead content may be used where only occasional lubrication is possible.

F18; high lead alloy of good casting characteristics.

F20; a hard bronze used for gears and worm wheels where requirements are severe; also aluminum - bronze and special analysis bronzes.

See advertisement, Page 299

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FERROWELD—Lincoln Electric Co., Cleveland. For arc welding cast iron. Has steel base to give solid weld on cast iron of greater tensile strength than the cast iron itself. Due to low current which can be used, hardening effect usually present along the line of fusion is materially reduced.

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FILLEX—Metal & Thermit Corp., New York 5. Arc welding electrode for machine frames and bases, diesel exhaust manifolds, hoists and other heavy weldments. Weld deposit: Ts, 62-70,000 psi; ys 52-58,000 psi; elong in 2 in., 25-31 per cent.

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FINKL—A. Finkl & Sons Co., Chicago.

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Type C; Cr-Ni-Mo; C 0.40; furnished heat-treated to various tempers. For large section forgings or forgings of irregular section not suitable for heat-treating by liquid quenching.

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Type CNM; C 0.40, Mn 60, Ni 1.50, Cr 0.90 and Mo 0.30; furnished in finished rods or bars. In heat-treated state: Ts, 135,000 psi; ys, 110,000 psi; elong in 2 in., 17 per cent; bhn, 285; weldability, good. For heavily stressed machinery forgings.

Type R; Cr-Ni-Mo; C 0.28; furnished in forgings, heat-treated to various tempers. For hammer piston rods, crankshafts and forgings subject to shock and vibration.

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FS Annealed; C 0.50, Cr, Ni and Mo; oil quench; for die blocks. Miscellaneous forgings subject to forging temperatures and/or abrasion.

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FX; C 0.55, Cr, Ni, and Mo; furnished heat treated to various tempers, all commercially machinable. For use as drop hammer dies and blocks, forging machine dies, backing-up rolls and dipper teeth.

- 2 3 - - - - -

Shell Die; Cr 4.50-5.00, high Si and Mo; normalized or quenched in oil or in air blast. For shell punches, mandrels and die inserts.

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FIRTHALOY—Firth-Sterling Steel Co., McKeesport, Pa. Highly developed form of sintered carbide adapted to wire drawing dies, extrusion dies and similar purposes.

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FIRTHITE—Firth-Sterling Steel Co., McKeesport, Pa. Hard metal composition of sintered carbides furnished in a number of grades to form wearing surfaces or the edges of cutting tools.

- - 3 4 5 - - -

FIVEPOINT DEEPHARD STEEL—Foote Bros. Gear & Machine Corp., Chicago. Low-carbon steel parts, regardless of SAE or NE type, manufactured by the company and hardened by its Five Point Deephard process which can be applied also to castings, forgings, bar or plate steel, and results in superior wearing qualities. Company also has special alloy steel of a nickel-moly-chrome analysis, used especially to improve cores where it is otherwise impossible to obtain core hardness over 300 brinell because of excessive bulk. Furnished complete only as gears, pinions, or machine parts.

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FLEETWELD—Lincoln Electric Co., Cleveland.

Shielded arc electrode for welding mild steel.

Type 5; for flat, vertical and overhead welding. Ts, 65-75,000 psi; impact resistance, 30-70 ft-lb (Izod); density, 7.84-7.86 grams per cc; corrosion resistance greater than mild steel. AWS Class E-6010.

Type 7; for general-purpose welding and where fit-up is not of the best; low spatter and slag loss, high burn-off rate. Physical properties as welded; ts 70-80,000 psi; yield point, 55-66,000; ductility, approximately 17 per cent elong, in 2 in.; sp gr, 7.80. AWS Class E-6012.

Type 9; heavily coated electrode of shielded-arc type specifically for flat welding of deep groove joints. Physical properties as welded; ts, 66-74,000 psi; yield point, 55-60,000; elong 20-30 per cent in 2 in.; sp gr, 7.85-7.86; operates either with dc or ac. AWS Class E-6020 and E-6030.

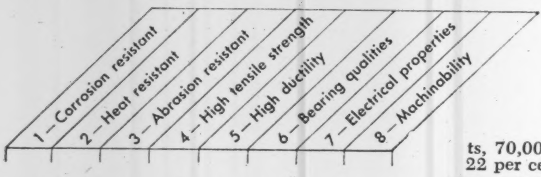
Type 9-HT; heavily coated electrode of shielded arc type for deep-groove welding in a flat position of high tensile steels. AWS Class E-7020 and E-7030.

Type 10; for downhand welding on flat surfaces for finish bead welding and to provide full slag coverage and smoothness. Can be used with either direct or alternating current normal or reverse polarity. AWS Class E-6020 and E-6030.

Type 11; heavily coated electrode of shielded arc type for downhand fillet welding with "Fleet-Fillet" technique. Physical properties similar to Type 9. AWS Class E-6020.

Type 35; for flat, vertical and overhead welding on both ac and dc. Physical properties similar to Type 5 electrode. AWS Class E-6011 and E-6010.

Type 37; for flat, vertical and overhead welding on mild steel. Especially designed for welding sheet metal. Physical properties similar to Fleetweld 7. AWS Class E-6013, E-6012, E-7011 and E-7012.



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FLYLITE—Magnesium Div., Howard Foundry Co., Chicago.

Grade No. 8; Al 5.3-6.7, Mn 0.15 min, Zn 2.5-3.5, Si 0.3 max, Cu 0.05 max, Ni 0.005, others 0.3, Mg remainder. As cast; for castings requiring moderate strength and toughness. Heat-treated; for castings requiring high strength and maximum toughness. Heat-treated and aged; for castings requiring high yield strength, hardness, moderate toughness.

Grade No. 4; Al 8.3-9.7, Mn 0.1 min, Zn 1.7-2.3, Si 0.3 max, Cu 0.05 max, Ni 0.005, others 0.3, Mg remainder. Characteristics similar to Flylite No. 8. Flylite No. 4 is preferred for maximum pressure tightness.

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FORT HOWARD Steel—Ford Howard Steel & Wire Div., Research Parts & Engineering Corp., Green Bay, Wis. Cold drawn round bars and wire, sizes $\frac{3}{16}$-in. through $\frac{5}{8}$-in. in the carbon and Bessemer grades.

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FRANKITE—Frank Foundries Corp., Moline, Ill.

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E-212; low-carbon electric furnace iron; pressure-resistant and long-wearing dense grain in heavy sections. For hydraulic bodies, refrigerator parts, compressor cylinders, etc. Good machinability.

1 2 - - - - 7 -
E-450; Ni 14, Cr 2, Cu 6, electric furnace Ni-Resist. Has corrosion resistance, heat resistance to 1500 F; fair machinability.

- - 3 - - - - -
E-604; Ni 4½, Cr 1½, electric furnace Ni-Hard white iron. Combats corrosion. For mixer blades, ash chutes, scrapers, etc.

1 2 - 4 - - - -
E-830-N; Cr 30, Ni 3, low carbon; heat-resistant. For continuous oven kilns, cement kiln cooler parts, furnace supports, etc.

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FRONTIER — Frontier Bronze Corp., Niagara Falls, N. Y. Available in following grades:

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40E; in sand castings and ingot form; not heat-treated; ts, 32,000 psi min; ys, 20,000 psi min; elong, 3-10 per cent. Resists salt water corrosion; abrasion resistance, high; excellent machinability; resistant to hydrostatic pressure; resistance to shock and impact, high. For parts now being produced of aluminum or gray iron.

No. 5 aluminum bronze; in castings; ts, 60-95,000 psi; comp str, 22-65,000; ductility, good; bhn, untreated, 130; heat-treated, 130-200. For parts where resistance to shock, fatigue and wear are essential.

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No. 11 nickel bronze; good bearing qualities with positive lubrication; wear-resistant; heat-treated, ts, 60-70,000 psi; ys, 38-45,000; elong, 15-20 per cent; bhn, 160.

G, H

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G ALLOY—American Smelting & Refining Co., New York. Lead-bearing alloy furnished in ingots for spinning and mold casting. Resists heat to 300 F; abrasion resistance, high; ts, 10,000 psi; comp str, 15,000 psi; good bearing properties; bhn, untreated, 22. Used for bearing applications. Is being widely substituted for tin babbits.

1 2 3 - - - - -
GEMPCO—The General Metals Powder Co., Akron, O. Metallic friction materials made of powdered copper and other powdered metallic and nonmetallic ingredients, blended, compressed to shape and heat-treated. Riveted or brazed to metal backing. Thicknesses from 0.012-in. up. For clutch disks, clutch and brake linings.

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GENESSEE—Symington-Gould Corp., Rochester, N. Y.

Structural alloy steels in the following grades:

194; C 0.20, plus Mo; normalized and drawn, ts, 65,000 psi; ys, 35,000 psi; elong in 2 in., 24 per cent.

196; C 0.25, plus Mo; normalized and drawn, ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 22 per cent.

197; C 0.25, plus Mo and Cr; normalized and drawn, ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 22 per cent.

180; C 0.30, plus Mn; normalized and drawn, ts, 80,000 psi; ys, 40,000 psi; elong in 2 in., 18 per cent; bhn, 160.

185; C 0.27, plus Mn and Mo; normalized and drawn, ts, 85,000 psi; ys, 53,000 psi; elong in 2 in., 22 per cent; bhn, 170.

193; C 0.31, plus Mn, Cr and Mo; normalized and drawn, ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 22 per cent; bhn, 180.

195; C 0.27, plus Mn, Cr and Mo; normalized and drawn, ts, 100,000 psi; ys, 70,000 psi; elong in 2 in., 18 per cent.

191; C 0.30, plus Mn, Cr and Mo; water-quenched and drawn, ts, 105,000 psi; ys, 85,000 psi; elong in 2 in., 17 per cent.

Also corrosion-resistant alloys, as follows:

255; C 0.20, plus Cr and Mo; normalized and drawn, ts, 105,000 psi; bhn, 210; max cont. serv. temp, 1100 F. Resistant to oxidation and creep.

212; C 0.20, plus Cr; oil-quenched and drawn, ts, 145,000 psi; bhn, 290; max cont. serv. temp, 1400 F. Resistant to wear and acids.

KA2; C 0.20 max, plus Cr and Ni; water-quenched, ts, 70,000 psi; bhn, 150. Resistant to tarnish and acids.

KA4; C 0.20 max, plus Cr, Ni and Mo; water-quenched, ts, 75,000 psi; bhn, 160. Resistant to sulphites.

280; C 0.30 plus Cr and Ni; no heat treatment required; ts, 100,000 psi; bhn, 200; max cont. serv. temp, 2000 F. Resistant to acids.

Also heat-resistant alloys, as follows:

315; C 2.80 plus Cr, Mo and Si; ts, 40,000 psi; bhn, 250; max cont. serv. temp, 1300 F. For grate bars and stove parts.

303; C 0.20 plus Cr and Ni; ts, 75,000 psi; bhn, 150; max cont. serv. temp, 2100 F. For parts requiring resistance to hot gases, high in sulphur.

304; C 0.35 plus Ni and Cr; ts, 70,000 psi; bhn, 140; max cont. serv. temp, 2000 F. For general high-temperature service.

305; C 0.15 plus Ni, Cr and Mo; ts, 60,000 psi; bhn, 120; max cont. serv. temp, 2000 F. For quenching baskets, etc.

Also abrasion-resistant alloys, as follows:

412; C 1.30 plus Mn and Cr; bhn, 200. For parts requiring impact and abrasion resistance, such as crusher plates.

500; C 3.10 plus Cu, Mn and Si; bhn, 550. For parts requiring abrasion and erosion resistance, such as coke chutes, etc.

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GENEX—Metal & Thermit Corp., New York 5. Arc welding electrode for general purpose fabrication. Weld deposit: Ts, 68-80,000 psi; ys, 53-65,000 psi; elong in 2 in., 17-25 per cent.

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GIBSILOY—Gibson Electric Co., Pittsburgh. Electrical contacts having low contact resistance, nonsticking properties, long life under arcing conditions.

A; silver-nickel. A-1; Ag 95, Ni 5; to A-8; Ag 60, Ni 40; in contact rivets, disks, screws and other shapes and in sheets and wire. Lowest contact resistance; highly ductile.

C; silver-graphite. C-1; silver 99, graphite 1; to C-7; silver 93, graphite 7; in contact disks and other shapes and in sheets. Best nonsticking properties.

NW; silver-nickel tungsten; various combinations in contact disks and other shapes and in sheets. Hard, arc resisting.

See advertisement, Page 304

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GLACIER—Glacier Metal Co., Richmond, Va.

Antifriction metal; sold in ingots; recommended pouring temperature, 600 F; bhn, 24.1; load to reduce height of test piece by 0.001, 4599 psi; load required to compress test piece 50 per cent of original height, 26,118 psi; sp gr, 9.976; wt, lb per cu in, .359.

Genuine Sovereign babbitt; ys, 5 tons per sq in.; elong in 2 in., 16.7 per cent; bhn, 28.4; load to reduce height of test piece by 0.001 in., 9800 psi; sp gr, 7.327; wt, lb per cu in .263; pouring temperature, 800 F. For bearings.

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GLOBE Tubing—Globe Steel Tubes Co., Milwaukee.

Carbon seamless tubes in low and medium carbon for mechanical purposes. Furnished hot-finished and cold-drawn to wide range of sizes; also annealed or cold-drawn stress relieved to higher physicals for strength and machinability.

Carbon seamless steel pressure tubing in low and medium carbon for boiler, condenser, heat exchanger tubes, straight and formed.

Alloy seamless steel tubing in low and medium carbon in SAE and NE grades for mechanical and aircraft tubing; in regular and magnaflux quality. Intermediate alloys such as 5 per cent to 9 per cent Chrome Moly for petroleum industry.

Stainless seamless tubing in austenitic 18-8 types. Low carbon Type 304, stabilized Types 321 and 347 for welding and maximum corrosion and heat resistance; for dairy, food, chemical industries. Types 329 and 443 for corrosion resistance in specific applications in chemical and textile fields. Straight chrome Types 410 for heat treating where high tensile and toughness with mild corrosion resistance is required. Type 430 for chemical service, especially nitric acid; also for heat resistance applications. Type 446 for high temperature service where load carrying requirements are not severe, good resistance to high sulphur atmospheres. Used where nickel bearing grades are objectionable. For further data on properties and applications, see "Stainless Steels" listings elsewhere in this section.

See advertisement, Page 261

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GLOBEIRON—Globe Steel Tubes Co., Milwaukee. High purity ingot iron in seamless tubing providing high magnetic permeability for electrical purposes. Offers some corrosion resistance in certain special cases because it approaches pure iron.

See advertisement, Page 261

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GLOWELD—Globe Steel Tubes Co., Milwaukee, Stainless welded tubing in Types 304, 347 and 316 and special analyses for applications similar to seamless types listed elsewhere for the company. Type 316 can be used in chemical and textile fields. For property and application data, see "Stainless Steels" listing elsewhere in this section.

See advertisement, Page 261

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GLYCO Babbitt—Joseph T. Ryerson & Son Inc., Chicago 80. General tradename covering a group of specially processed lead-base alloys including:

Turbo-Glyco; for bearings for high-speed, heavy duty; avg bhn, 30.

Marine Glyco; for bearings for electric motor and marine work; avg bhn, 27.

Standard Glyco: free flowing, general purpose babbitt; avg bhn, 24.

Heavy pressure mill Glyco; high resistance to crushing loads; high bearing temperatures, avg bhn, 23.

Transmission Glyco; for line shafting and transmission work; avg bhn, 22.

See advertisement, Page 310

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GOLD ANCHOR Drill Rod—Anchor Drawn Steel Co., Latrobe, Pa. C 0.70, W 18, Cr 4, V 1.00, Si 0.25, Mn 0.25. Oil or air-quenched and double-tempered; hardness, rockwell C, 67 max; magnetic; weldability, poor; abrasion resistance, high; max cont. serv. temp, 1200 F. For dies, high-temperature springs, dowel pins, punches, etc.

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GRAMIX—United States Graphite Co., Saginaw, Mich. Porous metal bearings and mechanical shapes, made in several grades of which the following is typical:

No. 81 sintered bronze; ts, 15,000 psi; compressive force to cause .001-in. permanent set, 10,000 psi; apparent density, 6.4-6.6 grams per cu-cm; oil absorption (by volume), 20-30 per cent; coefficient of thermal expansion (70-200 F), .00000934 in. per in. per deg F.

No. 86 sintered iron; ts, 20,000 psi; compressive force to cause .001-in. permanent set, 16,000 psi; apparent density, 5.8-6.1 grams per cu cm; oil absorption (by volume), 15-20 per cent; coefficient of thermal expansion, (70-200 F), .0000071 in. per in. per deg F.

See advertisements, Pages 147, 160-161

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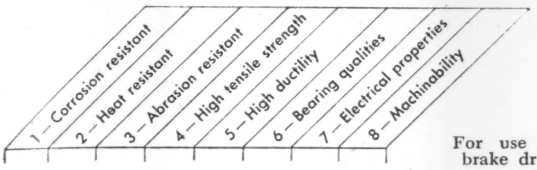
GRAPH-AL—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, O. C 1.50



avg, Si 0.30 max, Mn 0.30 max, P and S 0.25 max, Al 0.12-0.20; furnished in rough bars or billets, finished rods or bars, straight and coiled strip, wire, sheet, plate and forgings; for machining, hot and cold working, brazing, and arc, gas and resistance welding. For annealing, normalize 1700 F; furnace-cool from 1380-1150 F; quench 1450-1500 F into brine. In cold-worked state: Ts, 105,000 psi; ys, 53,000 psi; elong in 2 in., 15.5 per cent; impact str, 120+ ft-lb (Izod); quenched hardness, 67-68 rockwell C. Weldability, good; abrasion resistance, high. For applications requiring high impact resistance such as swaging rolls, etc.

See advertisement, Page 273

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GRAPHITSTEEL—Pettibone Mulliken Corp., Chicago 51. Carbon steel, 0.80 combined carbon, 0.60 graphitic carbon; supplied in annealed state (235 bhn). To harden, 1525 F, oil quench, then draw to desired hardness. In annealed state: Ts, 105,000 psi; ys, 70,000 psi; elong in 2 in., 8 per cent; bhn, 235; magnetic; has high wear resistance (metal to metal wear). For cams, gears, rolls, crankshafts, cylinders and liners, etc.

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GRAPHALLOY — Graphite Metallizing Corp., Yonkers 3, N. Y.

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Babbitt; carbon-graphite metallized (impregnated) with babbitt; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, approx 5000 psi; comp str, 18,400-23,100 psi; hardness, 45-61 (Shore scleroscope); nonmagnetic; max cont. serv. temp, 300 F. For oilless bushings.

1 - - - - 6 7 -
Copper; carbon-graphite metallized (impregnated) with copper; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, 5000 psi; comp str, 19,200-24,500 psi; hardness, 48-63 (Shore scleroscope); nonmagnetic; max cont. serv. temp, 700 F. For oilless bushings and motor brushes.

Cadmium; carbon-graphite metallized (impregnated) with cadmium; furnished in rough bars, finished rods and bars, for machining. In untreated state: Ts, 4000-5000 psi; comp str, 18,000-20,000 psi; hardness, 45-61 (Shore scleroscope); max cont. serv. temp, 250 F. For oilless bushings and electric contacts.

1 - - - - 6 - -
GRAPH-MO—Timken Steel & Tube Div. The Timken Roller Bearing Co., Canton, O. C 1.5, Si 0.8, Mn 0.4 max, P and S .025 max, Mo 0.25; in hot-rolled bars or billets, finished rods or bars, seamless tubing, wire, strips, sheets, plates and forgings. Has high abrasion resistance; ts, 85,000 psi, min; medium ductility; fair bearing properties; good weldability; good nonscuffing properties; bhn, annealed, 197, heat-treated, 745. Used for spindles, wear plates, jigs, fixtures, dies and tools. All parts requiring resistances to wear and nonscuffing properties.

See advertisement, Page 273

- - 3 4 - - - 8
GRAPH-M.N.S.—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. C 1.5; Mn 1.25; P .025 max; S .025 max; Si 1, Ni 1.75. Mo 0.5, Cr 0.5; in hot-rolled bars and billets, finished rods and bars, wire, sheets, strip, plates and forgings. Has high resistance to abrasion, and nonscuffing properties when cold forming metal; ts, annealed, 135,000 psi; medium ductility. Weldability, good; bhn, annealed, 241; heat-treated 682. Used for various types of machine parts, having light walls and nonuniform sections as well as cold-working dies and tools.

See advertisement, Page 273

- - 3 - - 6 - -
GRAPH-SIL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. C 1.5, Si 0.9-1. Mn 0.5 max. P and S .025 max; in hot-rolled bars or billets, finished rods or bars, seamless tubing, wire, sheets, strips, plates and forgings. Ts, 97,500 psi; abrasion resistance, high; medium ductility; ys, 56,000 psi; elong in 2 in., 25.5 per cent; bhn, 187; excellent machining and nonscuffing properties; good weldability. For use as cylinder liners, pump liners, brake drums, and tools and dies.

See advertisement, Page 273

- - 3 4 - - - 8
GRAPH-TUNG—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, O. C 1.50 avg, Si 0.65 avg, Mn 0.50 max, Mo 0.50 avg, W 2.80 avg; furnished in rough bars or billets, finished rods or bars, straight strip, wire sheet, plate, and forgings; for machining, hot and cold working, brazing, and arc, gas and resistance welding. Weldability, good; abrasion resistance, high. For parts requiring maximum wear resistance.

See advertisement, Page 273

1 - 3 - - 6 - -
GRAPHO Babbitt Metal—Lehigh-Babbitt Co., Allentown, Pa. Babbitt metal of different grades, mixed with graphite; can be poured as regular metal without losing graphite content. Mechanical properties similar to those of other babbitt metals; for bearings.

- - - 4 - - - -
GUNITE—Gunite Foundries Corp., Rockford, Ill. Ten grades of cast iron in following:

A; processed cast iron. In untreated state: Ts, 40,000 psi; bhn, 223.

A-1; processed cast iron. Oil quench for brinell over 400. In untreated state: Ts, 40,000 psi; bhn, 223.

B-1; processed cast iron. Oil quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 255.

C; processed cast iron. In untreated state: Ts, 35,000 psi; bhn, 212.

D; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 248.

E; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 229.

E-1; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 40,000 psi; bhn, 223.

F; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 262.

R; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 50,000 psi; bhn, 269.

S; processed cast iron. Oil-quench for high hardness. In untreated state: Ts, 45,000 psi; bhn, 248.

Also standard ASTM grade malleable irons as follows:

35018; castings. In annealed state: Ts, 53,000 psi; ys. 35.000 psi; elong in 2 in., 18 per cent min; bhn, 130.

32510; malleable castings. In annealed state: Ts, 50.000 psi; ys. 32,500 psi; elong in 2 in., 10 per cent min.

50004; pearlitic malleable iron castings. In heat-treated state: Ts, 80,000 psi; ys, 50,000 psi; elong in 2 in., 4 per cent min; bhn, 207.

Cast steels available as follows:

30-70; in heat-treated state: Ts, 70,000 psi min; ys, 35,000 psi min; elong in 2 in., 24 per cent min; bhn, 150.

45-80; in heat-treated state: Ts, 80,000 psi min; ys, 40,000 psi min; elong in 2 in., 17 per cent min; bhn, 170.

32X105; in heat treated state: Ts, 105,000 psi min; ys, 85 000 psi min; elong in 2 in., 15 per cent min; bhn, 217.

1 - - 4 5 - - -
HANDY FLUX—Handy & Harman, New York 7. For brazing steel, stainless steel, Monel metal, nickel, copper, beryllium-copper, brass, bronze, aluminum-bronze and various other ferrous and nonferrous metals and alloys. Liquid and active at 1100 F.

1 2 3 - - 6 - -
HARDEX—Metal & Thermit Corp., New York 5. A series of arc welding electrodes, Nos. 20, 25, 45 and 60, for hard facing drills, dippers, hammers, rollers, crushers, wobblers, sprockets, spindles, impellers, idlers, scraper blades, wearing plates, etc.; with characteristics such as high corrosion resistance, high abrasion resistance and good bearing qualities.

- 2 3 4 - - - -
HARDTEM—Heppenstall Co., Pittsburgh. C 0.5, Cr-Mo-V die steel; for die blocks, shafting, etc.

- - 3 4 5 - - -
HARDWELD—Lincoln Electric Co., Cleveland. High-carbon arc welding electrode having bhn of 225-488. Provides dense, tough surface of moderate hardness to enable various steel parts to resist shock and abrasion; for locomotive or crane tire flanges, etc.

Type 50; medium-carbon steel electrode for building up steel parts and surfaces. Deposit has considerable resistance to deformation and wear, and is machinable at slow speed. Coating stabilizes the arc and permits deposition of a tough, dense medium carbon steel. Hardness, deposited on straight-carbon steel and allowed to cool naturally, 20 to 35 rockwell C.

1 2 3 - - - - -
HARDY Metal Powders—Charles Hardy Inc., New York 17. Metal powders of various kinds including aluminum, brass, copper, iron, tungsten, manganese, nickel, etc.; available commercially; when compressed into parts give most physical characteristics which are available from metal or alloys produced by melting and casting. According to metal powders chosen and method of processing, variations in all of the properties can be obtained.

- - - - - 6 - -
HARRIS 80-10-10—Arthur Harris & Co., Chicago 7. Cu 80, Sn 10, and Pb 10; furnished as sand castings. Used for bearings and pressure castings.

- - 3 - - - - -
HASCROME—Haynes Stellite Co., Kokomo, Ind. Cr 10-14, C 0.80-1.20, Mn 3-5, Fe balance; welding rod for hard-facing parts subject to abrasion and impact, and castings to resist abrasion and impact.

See advertisement, Page 141

1 2 - 4 - 6 - -
HASTELLOY—Haynes Stellite Co., Kokomo, Ind. Corrosion-resistant, nickel-base alloys in following grades:

1 2 - 4 - - - -
A; C 0.02-12, Mo 17-21, Fe 17-21, Ni balance. Furnished in rough bars, finished rods or bars, straight strip, welded tubing, wire, sheet, plate, and as sand castings; for machining, hot working, stamping, drawing and arc, gas and resistance welding. As cast: Ts, 69-78,000 psi; ys, 42,500-45,000 psi; elong, 8-12 per cent; bhn, 155-200; impact str, 25-35 ft-lb (Izod). Rolled, annealed: Ts, 110-120,000 psi; ys, 47-52,000 psi; elong, 40-48 per cent; bhn, 200-215. For all types of chemical equipment, coils, vessels, heat exchangers, etc.

B; Mo 24-32, Fe 3-7, C 0.02-0.12, Ni balance. Furnished in rough bars, finished rods or bars, straight strip, welded tubing, wire sheet, plate and castings; for machining, hot working, drawing, brazing, and arc, gas and resistance welding. As cast: Ts, 75-82,000 psi; ys, 55-57,000 psi; elong, 6-9 per cent; hardness, rockwell B, 92-99. Rolled-annealed: Ts, 130-140,000 psi; ys, 60-65.000 psi; elong, 40-45 per cent; hardness, rockwell B, 96-100; sp gr, 9.24; abrasion resistance, medium. For all types of chemical equipment and turbine blading.

C; Mo 14-19, Fe 4-8, C 0.04-0.15, Cr 12-16, W 3-5.5, Ni balance. Furnished in rough bars, finished rods or bars, welded tubing, wire, sheet, plate and castings; for machining, hot working, stamping, drawing, brazing and arc, gas and resistance welding. As cast: Ts, 72-80,000 psi; ys, 45-48,000 psi; elong in 2 in., 10-15 per cent; hardness, rockwell B, 89-97. Rolled annealed: Ts, 115-128,000 psi; ys, 55-65,000 psi; elong in 2 in., 25-50; hardness, rockwell C, 50-55. Sp gr, 8.94; max cont. serv. temp, 2000 F; abrasion resistance, medium. For all types of chemical equipment, also exhaust gas systems for aircraft, heat-treat furnace parts, and carburizing furnace parts.

1 - 3 - - 6 - -
D; Si 11, Cu 2-5, Al 1 max, Ni balance. Furnished as castings and cast welding rod. In untreated state: Ts, 36-40,500 psi; hardness, rockwell C, 50-55; sp gr, 7.80; nonmagnetic; max cont. serv. temp, 1200 F; abrasion resistance, high. For equipment for handling hot sulphuric acid, also for wear parts such as sleeves, bushings, etc.

See advertisement, Page 141

1 2 3 - - - - -
HAYNES STELLITE—Haynes Stellite Co., Kokomo, Ind. Welding rods and castings in following grades:

1; Cr 28-34, W 11-15, Co balance. Cast hard-facing rod. In untreated state: Ts, 47,000 psi; comp str, 256.000 psi; hardness, rockwell C, 54 (gas welded) and 45 (arc welded);

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing qualities
7—Electrical properties
8—Machinability

sp gr, 8.59; nonmagnetic; max cont. serv. temp, 2000 F; abrasion resistance, high. For hardfacing farm implements, screw conveyors, mixing machine plows, bed plates, guides, cams, scrapers, stripping knives, and other applications requiring resistance to heat, abrasion and corrosion or combinations of these, and where only moderate shock is encountered.

6; Cr 25-31, W 3-6, Co balance. Hardfacing rod. Ts, 105,000 psi; comp str, 220,000 psi; elong in 2 in., 1 per cent; hardness, rockwell C, 40-46; sp gr, 8.38; nonmagnetic; weldability, good; max cont. serv. temp, 2000 F. For valves, disk gates and plugs for steam, gas H_2O, knives, strippers, rolls, shafts, sleeves, etc., where heat, abrasion and corrosion resistance are required, and where more ductility and shock resistance is needed than that of Alloy No. 1.

12; Cr 26-32, W 6-10, Co balance. Hardfacing rod and castings. In untreated state: Ts, 76,000 psi; comp str, 193,000 psi; hardness, rockwell C, as cast, 46-58, as deposited, gas, 48; sp gr, 8.40; nonmagnetic; max cont. serv. temp, 2000 F. For guides, hammers and other applications similar to those given for Nos. 1 and 6, where higher strength and abrasion resistance is required.

1 2 - - - - - -
21; C 0.20-0.35, Cr 25-30, Ni 1.50-3.5, Mo 4.5-6.5, Fe 2 max. Furnished in sheets and sand and precision castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts, 101.300 psi; ys, 82 300 psi; elong in 2 in., 8.2 per cent; hardness, rockwell C, 28-32; sp gr, 8.30; nonmagnetic; max cont. serv. temp, 2000 F; abrasion resistance, high; good long-time properties at elevated temperatures. Endurance strength in alternate bending at 120 cycles per second at 10^8 cycles, room temp, 35-40 000 psi; at 1200 F, 44.000 psi; and at 1500 F, 33 000 psi. For turbine blading, exhaust systems for aircraft and other high-temperature applications.

23; C 0.35-0.50, Cr 23-29, Ni 1.50 max, W 4-7, Fe 2 max, Co balance. Furnished in sheets and castings, for hot working, brazing, arc, gas and resistance welding. In untreated state: Ts, 105,400 psi; ys, 58,400 psi; elong in 2 in., 7 per cent; hardness, rockwell C, 28-32; sp gr, 8.54; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance, medium. For turbine blading and other high-temperature applications. Material has good long-time properties at elevated temperatures.

27; C 0.35-0.50, Cr 23-29, Mo 5-7, Fe 2 max, Co 30 min, Ni balance. Furnished in sheet and castings, for hot working, brazing, and arc, gas and resistance welding. In untreated state: Ts, 82,500 psi; ys, 46,900 psi elong in 2 in., 7 per cent; hardness, rockwell C, 17-22; sp gr, 8.21; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp. 2000 F; abrasion resistance medium. Good long-time elevated-temperature properties. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F. 41.000 psi; at 1500 F, 38.000 psi. For turbine blading and other high-temperature applications.

30; C 0.35-0.50. Cr 23-29, Ni 13-17, Mo 5-7, Fe 2 max, Co balance. Furnished in sheets and castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts 100 000 psi; ys, 65 000 psi; elong in 2 in., 6 per cent; hardness, rockwell C, 28-32; sp gr, 8.31; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp. 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading and other high-temperature applications.

31; C 0.45-0.60, Cr 23-28, Ni 9-12, W 6-9, Fe 1 50 max. Co balance. Furnished in sheets and castings; for hot working, brazing, and arc, gas and resistance welding. In untreated state: Ts, 101.000 psi; ys, 74 100 psi; elong in 2 in., 11 per cent; sp gr, 8.61; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont. serv. temp, 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles; at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading etc.

- - 3 - - - - -
93; Xe 15-19, Co 4-7, V 0.5-3, Mo 13-17, Fe balance. Cast welding rod; heat to 1950 F and air cool. As cast: Ts, 43,000 psi; comp str, 407,800 psi; hardness, rockwell C, 62 as deposited, gas welded. In heat-treated state: Ts, 34,700 psi; comp str, 285,300 psi; hardness, rockwell C, gas welded, heat treated, 66-67; arc welded, heat treated, 63-64. Suitable for hardfacing where high cold hardness is necessary and corrosion is not an important factor; for applications which tend to grind away a metallic surface, such as dredge pump impellers, cement clinker crusher rolls, etc.

1 2 3 - - - - -
92M2; Cr 27-31, W 16-19, Co balance. Furnished as castings. In untreated state: Ts. 63.000 psi; hardness, rockwell C, 62-64; nonmagnetic; resists corrosion caused by high-temperature oxidation; max cont. serv. temp, 1800 F; abrasion resistance, high. For metal-cutting tools, for cast iron, steels, nonferrous alloys and nonmetallic materials; gages, bushings and special castings requiring resistance to heat, abrasion and corrosion, or combinations of these.

Star-J Metal; Cr 29-34, W 15-19, Co balance. Furnished as castings. In untreated form: Ts, 65 000 psi; hardness, as cast, rockwell C, 58-62; sp gr, 8.76; nonmagnetic; weldability, good; resists corrosion all atmospheric conditions including brine, also 10 per cent boiling HNO_3, boiling acetic and ferric sulphate, and 10 per cent solutions of ferric chlorides; max cont. serv. temp, 2000 F; abrasion resistance, high. For metal cutting tools, gages, valves and seats. bushings, guide rolls, cam followers, and other special castings requiring resistance to heat, abrasion and corrosion, or combinations of these encountering only moderate shock or impact where maximum hardness is required.

See advertisement, Page 141

- - 3 - - - - -
HAYSTELLITE—Haynes Stellite Co., Kokomo, Ind. Cast tungsten carbide welding rod, furnished in following grades:

Hard grade; W 90-96, C 3.50-4.50 and Co 0.50-2.00. In untreated state: Hardness. rockwell A, 82-88, as deposited; abrasion resistance, high. For oil well drilling tools, rock bits, farm implements. earth moving equipment and other applications where utmost resistance to abrasion is necessary.

Tough grade; W 79-85, C 3.50-4.50 and Co 8-11. In untreated state: Hardness, rockwell A, 82-88; abrasion resistance, high. For hard setting oil well drilling tools, earth moving equipment. pulverizing hammers, and other applications where abrasion resistance is required.

See advertisement, Page 141

1 - - 4 - - - 8
HECLA Forging Bronze—Titan Metal Mfg. Co., Bellefonte, Pa. A naval bronze; Cu 59. Pb 1. Sn .75. balance Zn. Used where high tensile strength and resistance to corrosion are required.

- 2 3 4 5 - - -
HEPPENSTALL—Heppenstall Co., Pittsburgh.

- - - 4 5 - - -
2 C 30; Ni-Cr-Mo steel; C 0.3. For shafting where high torsional strength is required.

- 2 3 4 - - - -
5 H 50; C 0.5; Cr-Mo and V alloy; furnished as die blocks. Material is heat-resistant, abrasion-resistant; has high tensile strength and high ductility. Used for strip mill rolls, etc.

1 - - 4 5 - - -
HERCULOY—Revere Copper & Brass Inc., New York 17.

419 and 421; Si 1.5-2.25, either 0.25 Sn or 0.35 Mn, balance Cu; in rods or bars. tubing, wire, sheets, strips (coiled) and plates; for hot forging, stamping, extruding, welding. deep drawing and cold forging. Corrosion-resistant; medium abrasion-resistant; ts, 45-90 000 psi; high ductility. For cold-headed bolts, nuts, screws, nails, etc.

418 and 420; Si 3, either 0.5 Sn or 1 Mn, balance Cu; furnished in rods or bars, tubing, wire, sheets, strips (coiled) and plates; for hot forging, stamping, extruding, welding, deep drawing and cold forging. Ts, 55-120,000 psi; high ductility. Used for range boilers, and for applications requiring high strength in combination with good weldability and corrosion resistance.

See advertisements, Pages 263-264

1 - - - - - - -
HI-GLOSS—Jessop Steel Co., Washington, Pa. Standard stainless steel in Type 304. For property and application data, see "Stainless Steels" listings elsewhere in this section.

1 - - - - - - -
HILLS-McCANNA—Hills-McCanna Co., Chicago, Magnesium alloy sand castings; light in weight; have high strength; and are used for aircraft parts, etc.

- - - - - - 7 -
HIPERCO—Westinghouse Electric Corp., East Pittsburgh, Pa. Iron-cobalt alloy containing approximately 1/3 cobalt, 2/3 iron and 1 to 2 per cent of another element to increase electrical resistivity. Has high magnetic saturation value, also high permeability for magnetizing. Furnished in straight strip, sheet and plate for machining, and hot and cold forging. In untreated state: Ts, 25,000 psi; ys, 20,000 psi; elong in 2 in., 1-2 per cent; sp gr, 8.00. For electrical parts where high magnetic saturation value and high permeability for magnetic forces is desired.

1 - - - - - 7 -
HIPERNIK—Westinghouse Electric Corp., East Pittsburgh, Pa. A magnetic alloy consisting of 49.5 per cent nickel and 49.5 iron; manganese 0.1; extremely ductile. Developed for special magnetic properties at moderately low induction, primarily for radio applications. Also used for transformer laminations; melting point is 1450 C. For relays, radio and current transformers, etc.

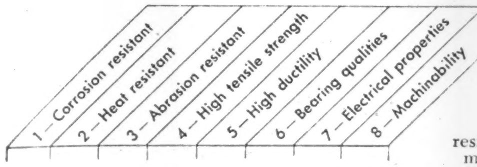
- - - - - - 7 -
HIPERSIL—Westinghouse Electric Corp., East Pittsburgh, Pa. A high-permeability silicon iron whose magnetic qualities exist only in the rolling direction. Lightweight; in finished core form only. For a variety of applications in communications field, including radio transformers. chokes. relays, reactors, etc. Available in three grades.

1 - - 4 5 - - -
HI-STEEL—Inland Steel Co., Chicago 3. C 0.12 max, Mn 0.50-0.90, P 0.050-0.120, S 0.05 max, Si 0.15 max, Cu 0.95-1.30, Ni 0.24-0.75, Mo 0.08-0.18, and Al 0.12-0.27, furnished in finished rods or bars, straight and coiled strip, sheet and plate; for machining, hot and cold working, stamping, drawing, brazing and arc, gas and resistance welding. Precipitation hardened for higher physical properties. Normally not heat-treated. In untreated state: Ts, 70,000 psi; ys, 52,500 psi; elong in 2 in., 22 per cent; endurance limit (completely reversed bending), 49,000 psi; bhn, 156-165; rockwell B, 82-85; wt., 0.283 lb per cu in.; weldability, good; abrasion resistance, high. For reducing deadweight and increasing payload of equipment such as railroad freight and passenger cars, trucks, busses, mine cars, street cars, etc., as well as earth moving machinery, furnaces and furnace parts, precipitators, concrete mixers, mufflers, etc.

1 - - 4 - - - 8
HITENSILOY Forging Bronze—Titan Metal Mfg. Co., Bellefonte, Pa. Cu 57, Pb 1, Ni 1.5, balance Zn. Ts, 80-95 000 psi; ys, 40-50 000 psi; elong in 2 in., 20-30 per cent; hardness, 70-90 rockwell B; modulus of elasticity, 25.000.000 psi. Has high strength and good corrosion resistance combined with good machinability. Used for pump rods, valve stems, bolts, nuts, etc.

1 - - 4 - - - -
HITEST—The Medart Co., St. Louis. Cast iron for ordinary cast-iron uses and for cast steel in some applications. Material is corrosion-resistant; has high tensile strength and good machinability.

- 2 - - 5 6 - -
HOTFORM—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. Available in three types: all furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for precision casting, machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Hardness rockwell C, 55-59 max; magnetic; weldability. fair; max cont. serv. temp, 800-1000 F; good bearing qualities.



No. 1; C 0.35, Si 0.90, Mn 0.30, Cr 5.00, Mo 1.40, W 1.20.

No. 2; C 0.35, Si 0.90, Mn. 0.30, Cr 5.00, Mo 1.40.

No. 3; C 0.50, Si 0.90, Mn 0.30, Cr 5.00, Mo 1.40, W 1.20.

All can be used for spindles, bearings, dies, shock-resisting applications at high temperatures, etc.

- - - - - 6 - -
HOYT BABBITT METAL—National Lead Co., New York 6. Analysis of material varies according to the bearing application.

1 - - - - - 7 8
HUSSEY Copper—C. G. Hussey & Co., Div. of Copper Range Co., Pittsburgh. Copper sheet, strip, drawn tubing and shapes, wire and rod to specification. Good machinability, weldability and formability. High general corrosion resistance. Excellent for electrical switch parts, bellows, eyelets, deep-drawn parts, trim for appliances, etc. Provides exceptionally good base for plating.

- - - - - 6 - -
HY-SPEED—Buckeye Brass & Mfg. Co., Cleveland. Cu 88, Sn 10, Pb 2. Bronze bars to customers' specifications in any ID, OD and length, slotted, drilled, flanged or threaded.

- - - - - - 7 -
HYTEMCO—Driver-Harris Co., Harrison, N. J. Alloy of nickel and iron characterized chiefly by its high-temperature coefficient of electrical resistance. Lends itself advantageously to uses requiring self regulation by temperature such as immersion heaters.

- - 3 4 5 - - 8
HY-TEN—Wheelock, Lovejoy & Co. Inc., Cambridge 39, Mass. Chrome-manganese-molybdenum and chrome-nickel-molybdenum alloys, in following grades:

- - 3 - 5 - - 8
A-1X; C 0.20, high Mn-Mo alloy steel, furnished in rough bars or billets finished rods or bars and forgings; for machining and hot working. In untreated state: Ts, 110,000 psi; ys, 65.000 psi; elong in 2 in., 25 per cent; impact str 85 ft lb (Izod) weldability, fair; abrasion resistance, high. For gears, bushings, cams, clutches, bolts, etc.

- - - 4 5 - - 8
B-2; C 0.40, Mn-Cr alloy steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. In cold-worked state: Ts, 100,000 psi; ys. 60.000 psi; elong in 2 in., 26 per cent; bhn. 187; weldability, fair. For shafts, gears, spindles, screws, studs, racks, etc.

B-3X; C 0.50, Mn-Cr-Mo alloy steel; furnished in rough bars or billets, finished rods or bars, and forgings; for machining and hot forging. In heat-treated state: Ts, 181.000 psi; ys, 164.000 psi; elong in 2 in., 14 per cent; impact str, 30 ft-lb (Izod); bhn, 388; weldability, fair; max. cont. serv. temp, 900 F. For gears, axles, spindles, clutches, etc.

- - 3 - 5 - - 8
B Temper No. 5; C 0.95, electric furnace steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. In heat-treated state: hardness, rockwell C, 65; abrasion resistance, high; machinability, good. For cold heading dies, rolls, bushings, gages, cams, etc.

- - 3 4 - - - 8
M Temper; C 0.70, Cr-Ni-Mo alloy steel; furnished in rough bars or billets, finished rods or bars and forgings; for machining and hot working. In heat-treated state: Ts. 291,000 psi; ys. 270 000 psi; elong in 2 in., 5½ per cent; impact str, 5 ft-lb (Izod); hardness, rockwell C. 60. For rolls, cams, clutches, collets, gears, gages, etc.

1 - - 4 5 6 - -
HY-TEN-SL-Bronze — American Manganese Bronze Co., Philadelphia 36. Al-Mn bronzes available in five grades as rough bars or billets finished rods or bars, castings and forgings, as follows:

1 - - 4 - 6 - -
No. 1; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts. 10.800 psi min; comp ys. 58.000 psi min; ys, 65 000 psi; elong in 2 in., 14 per cent; impact resistance, medium; bhn, 220; practically nonmagnetic; weldability, fair; heat resistant to 500 F; abrasion resistance, medium; pressure resistance, good. Used for lifting nuts, housing nuts, worm wheels (slow speed), spur and bevel gears, etc.

No. 1A; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts, 11,500 psi min; comp ys, 65,000 psi min; ys, 75,000 min; elong in 2 in., 12 per cent; impact resistance, medium; bhn, 240 min; practically nonmagnetic; weldability, fair; resists corrosion caused by water, air, etc; heat resistant to 500 F; abrasion resistance, medium. For same applications as No. 1.

No. 2 (sand cast); Ts, 100,000 psi; ys, 55,000 psi; elong in 2 in., 15 per cent; comp ys, 50,000 psi.

1 - - 4 5 - - -
No. 3; Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. In untreated state: Ts, 90,000 psi min; comp ys, 40 000 psi min; ys, 45,000 psi min; elong in 2 in., 20 per cent min; impact resistance, medium; bhn, 175; practically nonmagnetic; weldability, fair; resists corrosion caused by air, water, etc; heat resistant to 500 F; abrasion resistance, medium; good pressure resistance. For applications same as Nos. 1 and 1A.

No. 4 (sand cast); Ts, 85,000 psi; ys, 40,000 psi; elong in 2 in., 25 per cent; comp ys, 35,000 psi.

Also producers of manganese-bronze sand and centrifugal castings, hot-rolled and extruded rods, bars, shapes and sheets and forgings; gun metal sand and centrifugal castings; phosphor bronze sand castings; red brass sand and centrifugal castings; valve bronze sand castings; nickel-bronze and cupro-nickel castings; silicon bronze sand, centrifugal and permanent-mold castings, forgings, rods bars, sheets, tubing and extruded sections; and bearing bronzes.

See advertisement, Page 314

I, J, K

- - - - - 6 - -
IDEALOY—Wellman Bronze & Aluminum Co., Cleveland Copper-tin-zinc alloy for heavy-duty bearings.

- - - - 5 - - -
ILLINOIS Sheet and Strip—Illinois Zinc Co., Chicago 32. Sheet and strip zinc; furnished in straight and coiled strip and in sheet and plate, for stamping and drawing. In untreated state: Ts. 25,000 psi; weldability, poor; ductility, high. For nameplate and instruction plates, transformer cases, etc.

1 2 3 4 - - - 8
ILLIUM—Burgess Parr Co., Freeport, Ill.

1 2 - - - - - 8
G; Ni 54-58, Cr 20-24, Cu 5-7, Mo 5-7, Mn 0.75-1.5, Si .65 max, C 0.2 max. Available in cast rough bars or billets, cast tubing, cast plates and miscellaneous sand castings to specification. Other methods of fabrication include machining and welding. Bhn, 160-210; ts. 60-73 000 psi. For pumps, meters, chemical equipment and other parts subject to corrosion. Resists most corrosive solutions in a wide range of temperatures and concentrations including the halogens in dry state and their salts and acids in low concentrations at ordinary temperatures. Resists heat to 1900 F.

1 2 - 4 - - - 8
INCONEL—International Nickel Co. Inc., New York. High Ni-Cr-Fe alloy furnished in wrought and cast forms. Wrought forms: Rod and bar, cold drawn wire, hot-rolled plate, cold-rolled sheet and strip, cold-drawn tubing. Properties of wrought forms (ranges for various forms and tempers): Ts, 80-185.000 psi; ys. 25-175.000 psi; elong in 2 in., 50-2 per cent; bhn, 120-290. Good corrosion resistance; good hot and cold workability. Good high-temperature properties. For airplane-engine exhaust manifolds, springs that must operate at high temperatures, and in the food and chemical industries it is used for heaters, stills, condensers, tanks, piping, valves etc. In photographic field it is used for pumps, reels, shafts, etc.

Inconel Castings: Untreated: Ts. 70-95 000 psi; ys 30-45 000 psi; elong in 2 in., 30-10 per cent; bhn. 160-190; nonmagnetic; weldability, good; abrasion resistance, medium; good high-temperature properties; good corrosion resistance. For parts which need high corrosion resistance and/or resistance to elevated temperatures.

See advertisement, Page 143

1 - 3 - - 6 - -
INDIUM—The Indium Corp. of America, New York. A very soft metal used electrolytically or as a constituent of nonferrous alloys; commercial grade 99.9+ per cent pure; furnished in finished rods, bars, foil or powder; sp gr, 7.31; resists corrosion caused by salt spray and acids in oil; abrasion resistance, high. Used for bearing surfaces, protective coating for moving parts subject to wear and corrosion etc.

1 2 - 4 - - - -
INGACLAD—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Stainless clad steel consisting of a layer of 18-8 chrome-nickel, Type 304, also 18-8 columbium stabilized and 18-8 molybdenum bearing, stainless layer bonded to a layer of ordinary steel. Uses include equipment for chemical, food, dairy, processing, brewery, packing house, bottling industries, etc.; suitable for applications requiring stainless steel protection on one surface.

1 2 - - 5 - - -
INGERSOLL—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago. Stainless steel in sheets for stamping and welding into parts. Resists heat to 1200 F; abrasion resistance, medium; ts, 85,000 psi; ductility, high.

INLAND Steels—Inland Steel Co., Chicago 3. All AISI standard carbon steels, including those for which there are SAE equivalents; also steels to all ASTM and ARA specifications for carbon and carbon-silicon steel, structurals, plates, bars and semifinished products; also alloy steels including silico-manganese steels and chrome-manganese steels, for spring steel purposes. Also can furnish any metal to special chemical and physical requirements conforming to limits set up as standard by the AISI.

1 2 - 4 5 - 7 8
INTERNATIONAL NICKEL — International Nickel Co. Inc., New York.

Nickel: Ni 99.4, Cu 0.1, Fe 0.15, Mn 2, Si 0.05, C 0.1, S 0.005; rustproof, corrosion-resistant chemical parts.

- 2 - - 5 - - 8
L Nickel: a low carbon type of nickel, otherwise similar in chemical composition to nickel. Especially suitable in contact with fused caustic and certain fused salts.

- - - 4 5 - - 8
D Nickel: Ni 95.2, Cu 0.05, Fe 0.15, Mn 4.5, Si 0.05, C 0.1, S 0.005. A metal similar to nickel but affording superior mechanical properties and resistance to atmospheric attack at elevated temperatures; corrosion and heat-resistant; for electrical uses.

- - - 4 5 - - -
Z Nickel; Ni 98; heat-treatable material resembling nickel except for its higher mechanical properties which are comparable to those of oil-tempered spring steel; corrosion resistant. Used for products requiring spring properties with corrosion resistance.

1 - - - 5 - 7 -
Nickel Castings: Untreated; ts, 45-60,000 psi; ys. 20-30 000 psi; elong in 2 in., 30-15 per cent; bhn. 85-125; magnetic; weldability, good; abrasion resistance, medium; good corrosion resistance. For chemical and food-processing equipment parts.

See advertisement, Page 143

- - 3 4 - - - 8
INTRA Tool Steel—H. Boker & Co. Inc., N. Y. C. Water-hardening tungsten alloy steel. For taps, woodworking tools, mandrels, etc.

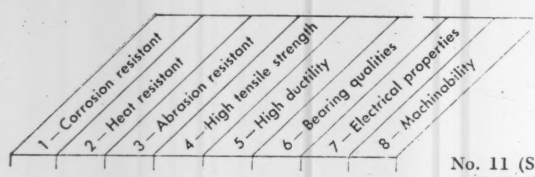
- - - - - - 7 8
INVAR—Carpenter Steel Co., Reading, Pa. Low expansion iron-nickel alloys, furnished in finished rods, bars, and strip. Various types available to meet expansion rates between different temperature ranges. Free-machining grade for automatic screw machine parts. Analyses for two types are:

Type 36: C 0.12 max, Mn 0.35, Si 0.20 max, and Ni + Co 36.

Type 36 Free-cut: C 0.12 max, Mn 0.35, Si 0.20 max, Ni + Co 36, and Se 0.20.

See advertisements, Pages 154-155, 286

- 2 3 - - - - 8
IRALITE—Mackintosh-Hemphill Co., Pittsburgh. C 2.8-3.5 plain and alloyed cast iron: Ni, Mo and Cr as required. Furnished as castings. Ts, 40-75.000 psi; bhn. 175-400; magnetic; resists corrosion caused by acids;



heat-resistant to 1500 F; abrasion resistance, high. For lathe and engine beds, etc.

J & L Steels—Jones & Laughlin Steel Corp., Pittsburgh 30. Cold-finished steel in bars, shapes, rounds, flats, hexagons and special shapes; easily machined. For gears, tubing, piston pins, generator parts and shafts, steering wheel hubs, etc. Also special cold-drawn shapes and Electricweld mechanical tubing.

See advertisement, Page 253

- - 3 - - - - -
JALLOY—Jones & Laughlin Steel Corp., Pittsburgh 30. Special steel for use where heavy impact and dynamic stresses are required. For parts such as pins and links on earth-moving, agricultural, mining and oil-well equipment.

See advertisement, Page 253

- - - - 5 - - -
JALCASE—Jones & Laughlin Steel Corp., Pittsburgh.

- - - - - - - 8
Low-carbon open-hearth steel which offers machinability practically equivalent to bessemer screw stock plus the added advantage of rapid case-carburizing properties; manufactured as AISI C-1117 and C-1118 (SAE 1117 and 1118), carbon 0.14-0.20.

- - - - 5 - - -
Open-hearth steel which in the higher carbon range offers exceptional heat treating qualities combined with forging properties and good machinability; manufactured as AISI C-1132 (SAE 1132), carbon 0.27-0.34; AISI C-1137 (SAE 1137), carbon 0.32-0.39; AISI C-1141 (SAE 1141), carbon 0.37-0.45.

See advertisement, Page 253

- - 3 4 - - - -
JEFALOY—The Jeffrey Mfg. Co., Columbus, O.

- - 3 4 - - - -
55M; total C 2.85-3.05, Mn 0.50-0.70, Si varying, Mo 0.70-0.80; furnished as castings; ts, 50-60,000 psi; comp str, 171-174,000 psi; bhn, 248,269. For wear-resistant, high-strength parts.

- - - 4 - - - -
A Series; C 2.85-3.50, Mn 0.30-0.75, Si varying; furnished as castings; ts 35-50,000 psi; comp str, 126-170,000 psi; bhn 192-248. For pump parts, gears, sprockets, frames, housings, etc.

1 - 3 4 5 - 7 -
JESSOP—Jessop Steel Co., Washington, Pa.

- - - 4 - - 7 8
Nonmagnetic steel; in rough bars or billets, finished rods or bars; sheets and plates. Medium abrasion resistance; ts, 80-110,000 psi; medium ductility; sp gr, 8.02; fair bearing properties; good weldability; bhn, untreated, 180; annealed, 150. Used for transformer covers, controller covers, etc.

1 - - 4 - - - -
Heat-resisting steels, in No. 4, 5 and 5-B grades; No. 4 has ts of 95,000 psi; ys, 50,000 psi. Used for castings, marine, submarine and torpedo parts, oil engine valves, pump shafts, etc. No. 5 has ts of 100,000 psi; ys, 45,400. Used for pump parts, etc. No. 5-B applications are similar to No. 5, but No. 5-B has superior resistance to corrosion, and is easier to fabricate. No. 5-B is similar in physical properties to No. 5 except that its tensile strength is greater.

1 - 3 - 5 - - -
Stainless-clad steel in any desired analysis and all degrees of cladding. Used for heads, tank wells, lids and any other part where corrosion resistance is important.

1 2 3 4 - 6 - -
JOHNSON—Johnson Bronze Co., New Castle, Pa.

1 - 3 - - 6 - -
Babbitts furnished in following grades:

No. 10 (SAE 10); Sn 90, Cu 5, Sb 5; furnished in rough bars or billets, for permanent-mold casting and die casting. Ts, 10-13,000 psi; comp str, 5-7000 psi; bhn, 28-30; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 200-250 F; abrasion resistance, high. For automotive main and connecting-rod bearings; high-speed, medium-load and precision-assembly bearings, etc.

No. 11 (SAE 11); Sn 87, Sb 7, Cu 6; furnished in rough bars or billets for permanent-mold and die casting. Ts, 10-13,000 psi; comp str, 5-6000 psi; bhn, 28-29; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 200-250 F. For automotive main and connecting-rod bearings subjected to heavy pressures.

No. LX (SAE 14); Pb 74-75, Sb 15, Sn 10, Cu 0.25; furnished in rough bars or billets, for permanent-mold or die casting. Annealed before machining. In untreated state: Ts, 8-12,000 psi; comp str, 5-6000 psi; bhn, 27-29; sp gr, 10.0; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont. serv. temp, 175-250; abrasion resistance, high. For car box journals, crane bearings, woodworking and metalworking machine tools, mining machinery bearings, etc.

- - 3 - - 6 - 8
Bronze alloys in following grades:

No. 19; Cu 70, Sn 11, Pb 19; cast to specifications, for machining. In untreated state: Ts, 22,500-32,500 psi; comp str, 13,000-15,000 psi; ys, 18,000-24,000 psi; elong in 2 in., 14-17 per cent; impact str, 3.4 ft-lb (Izod); bhn, 62; sp gr, 8.98; nonmagnetic; resists corrosion caused by atmospheric conditions and fresh water; max cont. serv. temp, 300-400 F; abrasion resistance, high. Used on mill bearings, gas and diesel engine bearings, excavating and pulverizing machinery, etc.

No. 25 (Plastic Bronze); Cu 75, Sn 5, Sb 19, Ni 1, cast to specifications for machining. In untreated state: Ts, 17,500-27,500 psi; comp str, 8-12,000 psi; ys, 13,750-19,750; elong in 2 in., 7-15 per cent; impact str, 5.2 ft-lb (Izod); bhn, 44; sp gr, 9.05; nonmagnetic; resists corrosion caused by diluted acids, atmospheric conditions, and fresh water; max cont. serv. temp, 300-400 F; abrasion resistance, high. For sleeve bearings used in pumps, electric motors, conveyors, fans, woodworking and lapping machines. For high speeds, light loads and no shock.

No. 27 (SAE 64); Cu 80, Sn 10, Sb 10, deoxidized with phosphorus; furnished in finished rods or bars and cast to specifications. In untreated state: Ts, 30-40,000 psi; comp str, 13-15,000 psi; ys, 16-22,000 psi; elong in 2 in., 10-30 per cent; impact str, 4.5 ft-lb (Izod); bhn, 58; sp gr, 8.75; nonmagnetic; resists corrosion caused by most acids highly diluted, sea air, atmosphere and fresh water; max cont. serv. temp, 300-400 F; abrasion resistance, high. For sleeve bearings for most machinery and machine tools, valve and pump parts, general automotive bearings, appliances, etc.

No. 29 (SAE 67); Cu 78, Sn 7, Sb 15; cast to specifications. In untreated state: Ts, 19-29,000 psi; comp str, 13-15,000 psi; ys, 13,400-19,400 psi; elong in 2 in., 5-13 per cent; impact str, 5.6 ft-lb (Izod); bhn, 52; sp gr, 8.9; nonmagnetic; resists corrosion caused by 20 per cent solution hydrochloric acid, other diluted acids, atmospheric conditions, etc.; max cont. serv. temp, 300-400 F; abrasion resistance, high. For high-speed sleeve bearing applications with medium loads and soft shafts, acid-resisting bearing applications, fractional horsepower motors, etc.

- 2 3 4 - - - -
No. 53 (SAE 62); Cu 88, Sn 10, Zn 2, cast to specifications. In untreated state: Ts, 31-41,000 psi; comp str, 13-16,000 psi; ys, 16-22,000 psi; elong in 2 in., 14-22 per cent; impact str, 8.5 ft-lb (Izod); bhn, 69; sp gr, 8.5; nonmagnetic; weldability, fair; resists corrosion caused by atmospheric conditions, fresh water, highly diluted acids and sea water; max cont. serv. temp, 600-900 F; abrasion resistance, high. For gears and gear bushings, piston-pin and valve-guide bushings, steering-sector and hinge bushings, heavy-duty bearings, high-pressure air valves.

1 - 3 - - 6 - -
No. 72 (SAE 660); Cu 83, Sn 7, Sb 7, Zn 3; furnished in finished rods or bars, cast to specifications. In untreated state: Ts, 24-34,000 psi; comp str, 12-14,000 psi; ys, 11,600-17,600 psi; elong in 2 in., 12-22 per cent; impact str, 8.6 ft-lb (Izod); bhn, 56; sp gr, 8.7; nonmagnetic; resists corrosion caused by atmospheric conditions, fresh water and highly diluted acids; max cont. serv. temp, 300-400 F; abrasion resistance, high. For general machinery bearing applications for medium loads, spring bushings (automotive), torque tubing and steering-knuckle bushings, piston-pin bushings, etc.

See advertisement, Page 251

1 2 - 4 - - - -
K-42-B—Westinghouse Electric Corp., East Pittsburgh. Ni 46, Co 20, Fe 12, Cr 18.75, Ti 2.25; furnished in rough bars or billets, rods or bars, wire, strips (coiled), and plates; for hot forging, stamping, turning, boring, welding, etc., also as sand castings. Resists corrosion caused by atmosphere and salt solutions; resists heat to 1200 C; ts, 127,100 psi; nonmagnetic; bhn, heat-treated, 280. For applications where high strength at high temperatures is required.

1 - 3 - - - - -
KENNAMETAL—Kennametal Inc., Latrobe, Pa.

- - 3 - - - - -
Grade KM; Tungsten-titanium carbide ($WTiC_2$) with other refractory metal carbides, and the optimum content of binder, furnished in powder metal, sintered form. Not heat-treatable. Trans. str, 305,000 psi; comp str, 650,000 psi; ys, 305,000 psi; impact str, 0.75 ft-lb (Charpy); endurance limit, 85,000 psi; hardness, rockwell C, 77.6; sp gr, 12.00; magnetic permeability, 3.00; resistance to corrosion, excellent at room temp; max cont. serv. temp, 1200 F; abrasion resistance, high. For pins and rollers, bushings, cam followers, bearings, chuck jaws, spindles, check-valve balls and seats, seaming rolls, etc.

1 - 3 - - - - -
Grade K6; primarily composed of tungsten carbide with low content of cobalt binder; furnished in powder metal, sintered forms. Not heat-treatable. Trans. str, 225,000 psi; comp str, 900,000 psi; ys, 225,000 psi; impact str, 0.75 ft-lb (Charpy); endurance limit, 85,000 psi; hardness, rockwell C, 80.6; sp gr, 15.10; magnetic permeability, 1.5; resistance to corrosion, excellent at room temp; max cont. serv. temp, 1200 F; abrasion resistance, high. For valve tappets, work rests, dovetail ways, wear-proofing strips, guides, bushings, needle valves, feeding fingers, serrated inserts for clamping devices, band-saw guides, etc.

Grade K2-S; cobalt, $W\ Ti\ C_2$; WC. Used for machining cast steel; rockwell A, 91.5; trans. rupture, high; Young's modulus, 79,800,000 psi.

Grade K10; cobalt tungsten-carbide. Rockwell A, 91.0: trans. rupture, high; Young's modulus, 84,000,000 psi.

Grade K12; cobalt tungsten-carbide. Rockwell A, 89.2; trans. rupture, very high; sp gr, 14.19.

Grade KWS and Special; heat-resistant. According to requirements; will resist oxidation to 1600 F; rockwell A, 84-90. Strengths lower than in tool grades. For orifices operating at high temperatures.

Grade K3H; similar in composition to other types but harder. Compressive strength, 675,000 psi; transverse rupture strength, 260,000 psi; hardness, 91.8 rockwell A, (79.6 C); thermal conductivity, .068 cal/sec/deg C/cm; volume electrical conductivity, 3.3 per cent of copper; thermal expansion about 5.5×10^{-6}/deg C; sp gr, 11.0; Young's modulus, 72,100,000

Grade K4H; cobalt 7 per cent, tungsten-titanium carbide ($W\ Ti\ C_2$), and other ingredients. The hardest type of Kennametal. Has higher thermal conductivity than others. Used for precision boring of steel, machining steel, semisteel, brass, bronze, aluminum, etc. Compressive strength about 680,000 psi; transverse rupture strength, 225,000 psi; hardness, 92.3 rockwell A (80.6 C); thermal conductivity, .12 cal/sec/deg C/cm; volume electrical conductivity 5.3 per cent of copper; thermal expansion about 5.5×10^{-6}/deg C; sp gr, 12.45; Young's modulus, 79,600,000.

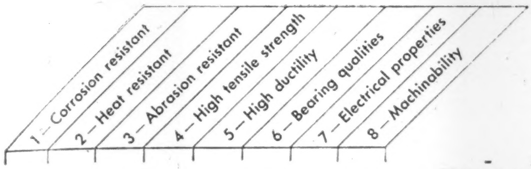
See advertisement, Page 290

KEYSTONE Steel—Keystone Drawn Steel Co., Spring City, Pa. Standard analyses cold-finished steel bars; carbon and alloy.

- - 3 4 - - - -
KINITE Tool Steel—H. Boker & Co. Inc., N.Y.C. High-carbon, high-chrome air-hardening tool steel furnished in bars, castings, forgings. For dies, cams, slitting cutters, etc.

- - 3 - - - - -
KLEENKUT—Heppenstall Co., Pittsburgh, Tool steel containing C 2 and Cr 12. For sheet knives for cold shearing light material.

1 2 - - - - 7 -
KOVAR A—Westinghouse Electric Corp., East Pittsburgh, Pa. Iron alloy containing 29 per cent nickel, 17 per cent cobalt and 0.3 per cent manganese. Ts, 89,700 psi; elong



in 2 in., 25 per cent; ys, 50,500 psi; high resistance to amalgamation with mercury and withstands high thermal shock. For any application demanding vacuum-tight, metal-to-glass joints.

L

- - - 4 5 - - 8
LA SULPHITE 8640—La Salle Steel Co., Hammond, Ind. C 38-43, Mn 75-100, P 0.04 max, Si 20-35, Ni 0.40-0.70, Cr 40-60, Mo 15-25; furnished in finished rods or bars for machining. Oil quench 1525-1550, temper to desired hardness. For gears, splines, shafts, axles, etc.

1 - 3 - - 6 - -
LEDALOYL—Johnson Bronze Co., New Castle, Pa. Cu 83-85, Sn 9.5-10.5, Pb 2-4 and graphite 1.5 max; furnished in powder metal parts to specification. In untreated state: Ts, 7-12,000 psi; comp str, solid block, 57-70,000 psi; or for hollow section, 35-50,000 psi; elong in 2 in., 2-5 per cent; bhn, 35-45; sp gr, 6.4-7.2; nonmagnetic; weldability, fair; max cont. serv. temp, 275 F max; abrasion resistance, high. For bearing applications in all types of industrial and household equipment where lubrication is remote or likely to be neglected.

See advertisement, Page 251

1 - - 4 5 - - -
LMC—Lewin-Mathes Co., St. Louis 2. Pure electrolytic copper, brass and bronze mixtures, Cupro Nickel; available in tubing. Used for all copper and brass tubing purposes.

- 2 - - - - - -
LO CRO—Crucible Steel Co. of America, New York. Stainless steels in standard forms—Types 501 and 502. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

1 - - - - 6 - 8
LOGAN Forging Brass—Titan Metal Mfg. Co., Bellefonte, Pa. Cu 58.5, Pb 1.9, balance, Zn. Ts, 60-65,000 psi; red. of area, 40 per cent; elong in 2 in., 40 per cent.

- - - - - 6 - -
LUBRICO—Buckeye Brass & Mfg. Co., Cleveland. Cu 75, Pb 20; Sn 5. For bearings, bushings, etc. Shock-resistant; self-lubricating.

- - - - - 6 - -
LUBRIK—Pittsburgh Brass Mfg. Co., Pittsburgh 1. Cu 85, Sn 10, Pb 2½, and Zn 2½; furnished in rough bars or billets for turning, boring, etc; bhn, 69. For heavy-duty bronze bearings. Hardened by addition of nickel.

1 - 3 4 5 - - 8
LUKENS—Lukens Steel Co., Coatesville, Pa.

2 per cent nickel steel; in plates and spun and pressed heads; for hot forging, stamping, welding, riveting, turning, boring, etc., into many types of machine parts where a high-tensile steel of good ductility is required.

- - - 4 5 - - -
Chrome-manganese steel; furnished same as above; ts, 100,000 psi. Used principally in fan blades and fan rings.

- - - - 5 - - -
3½ per cent nickel steel; furnished same as above; ts, 70,000 psi. Used where good resistance to impact is desired in parts operating in sub-zero temperatures.

- - - 4 5 - - -
Manganese-vanadium steel; furnished in same as foregoing; high-tensile steel with good welding properties. Used in construction of antiaircraft gun mounts and carriages as well as military tank parts.

- - 3 4 - - - -
Manganese-molybdenum steel; furnished same as foregoing; ts, 95,000 psi. For use in parts in which abrasion and high tensile strength is desirable.

1 - - - 5 - - 8
Nickel-clad, Super nickel-clad, Inconel-clad, Monel-clad and Stainless-clad steels are all clad metals or bi-metals consisting of light layer of corrosion-resistant super-nickel, nickel, Inconel, Monel or stainless steel bonded to a heavier base plate of steel. For corrosion-resistant parts.

- 2 3 4 - - - -
Chromium-nickel-molybdenum Steel; furnished in plate. Untreated: Ts, 90-110,000 psi; ys, 50,000 psi; elong in 2 in., 20 per cent; bhn, approx 195; magnetic; weldability, fair; abrasion resistance, high. For abrasion resisting parts at high temperatures where high stresses are involved.

Nickel-chromium steel; furnished in plate. Untreated: Ts, 80-100,000 psi; ys, 50,000 psi, min; elong in 2 in., 20 per cent; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring good ductility.

- 2 - 4 - - - 8
0.50 Molybdenum steel; furnished in plate. Untreated: Ts, 65-80,000 psi; ys, ½ of ts; elong in 2 in., 25 per cent; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring high strength at high temperatures.

1 - - 4 5 - - -
Chromium-copper-nickel steel; furnished in plate. Heat treated: Ts, 65,000 psi, min; ys, ½ of ts; elong in 2 in., 25 per cent; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts operating at low temperatures.

8½ Per cent nickel steel; furnished in plate. Heat treated: Ts, 90-110,000 psi; ys, 70,000 psi, min; elong in 2 in., 20 per cent; bhn, approx 200; magnetic; weldability, good; abrasion resistance, medium; for parts operating at extremely low temperatures.

- 2 - 4 - - - 8
Chromium-molybdenum steel; furnished in plate. Untreated: Ts, 70-90,000 psi; ys, 45,000 psi, min; elong in 2 in., 20 per cent; bhn, approx 160; magnetic; weldability, good; abrasion resistance, medium. For high-strength parts requiring good heat resistance.

1 2 - 4 5 6 7 8
LUMEN ALLOYS—Lumen Bearing Co., Buffalo 12 (Note: "Lumen Alloy," together with each of the following numbers and grades is a copyrighted term which should be used in specifying these materials. Thus, "Lumen Alloy No. 00A," etc.)

- - - - - 6 - -
Nos. 00A and 00C; high tin bronzes for high compression bearing applications.

- - - - 5 - - -
No. 1; zinc bronze for pressure castings including spur and bevel gears.

- - - 4 - 6 - -
No. 2; zinc bronze for machine parts, bearings, etc.

1 - - - - 6 - -
No. 3; zinc bronze for mine service and paper mill machinery and bearings.

- - - - - 6 - -
No. 4; phosphor bronze (leaded), for bearings.

- - 3 - - 6 - -
No. 4 chill cast; for heavy-duty bearings, etc.

No. 4A; high-phosphorus bronze (leaded) for bearings on hard steel.

- - - 4 - - - -
No. 5; general service casting alloy; red brass; for low pressure valve bodies, etc.

- - - - - - 7 -
No. 7; phosphor bronze; uses include trolley wheels and castings to be nickel or chromium plated.

- - - 4 5 - 7 -
No. 9; manganese bronze for machine parts requiring strength, electrical conductivity, and high pressure.

1 - - 4 - - - -
No. 11-C; (sand cast) aluminum bronze; for miter, bevel gears and bearings subject to impact.

1 2 - 4 - - - -
No. 11-C; (heat treated) ts, 65-100,000 psi; recommended where strength, corrosion and heat resistance are required.

- - - - - 6 - -
No. 14; zinc bronze, babbitt backing; for valve bodies, etc.

1 - - - - 6 - -
No. 15; phosphor bronze; for worm wheels, bearings, etc.

No. 15 chill cast; for worm gears, nuts and bearings.

- - - - - 6 - -
No. 15A; phosphor bronze (slightly leaded): for worm wheels, bearings, etc.

No. 15A; chill cast; for heavy-duty bearings and worm gear castings.

- - - 4 - - - -
No. 20; super-manganese bronze; for machine parts requiring extra strength.

- - - - - 6 - -
No. 31; for high-speed, low-duty bearings.

No. 33; for bearings, high-speed, low-duty.

- - 3 - - 6 - -
No. 43; nickel-tin-bronze alloy for bearings, gears and nuts; abrasion-resistant.

No. 43 (Chilled); nickel tin bronze for bearings, worm gears and nuts with higher tensile strength than No. 43.

1 - - - - 6 - -
No. 48; nickel-phosphor-bronze; for bearings used with hardened steel, worm wheels, etc.

- - - - - 6 - -
No. 48 chill cast; for bearings, worm gears, nuts, slippers, etc.

No. 54; phosphor bronze (leaded) for bearings and worm wheels for intermediate service.

No. 54 chill cast; for bearings, worm gears, nuts, etc.

1 - - 4 - - - -
No. 96; aluminum bronze, approximately 88 per cent Cu, 8.5 Al and 3.5 Fe; ts, 73,000 psi; ys, 25,000 psi; bhn, 114-121; sp gr, 7.7; and has medium abrasion resistance.

- - - - - 6 - -
Bronze; a zinc base alloy for bearings.

- - - 4 - - - -
M-13—Precision Castings Co. Inc., Syracuse, N. Y. Al 9, Mn 0.13, Zn 0.6, Si 0.5 max, with Mg base; die castings. Ts, 33,000-34,000 psi; ys, 21,000 psi; elong, 2 to 5 (3 av.) per cent in 1 or 2 in; impact resistance, low; bhn, 60; sp gr, 1.81; nonmagnetic; corrosion resistance, fair; heat-resistant to 700 F; abrasion resistance, medium.

M

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MACHEMPITE—Mackintosh-Hemphill Co., Pittsburgh. C 0.3-1.25, Mn 1.25-1.75, Mo 0.25-0.75; furnished as castings. Ts, 85-125,000 psi; ys 65-100,000 psi; elong, 25-5 per cent; impact resistance, low; bhn, 215-400; magnetic; weldability, good; abrasion resistance, medium. For gears, pinions, etc.

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MAGNOLIA—Magnolia Metal Co., Elizabeth, N. J.

Isotropic die cast bronze bar stock; Cu 80, Sn 10, Pb 10, and other alloys to suit conditions. Furnished in semifinished cored and solid bars, fully machined. Resists corrosion caused by acids; resists heat to 900 F; ts, 31,500 psi; comp str, 26,000; bearing properties, good; bhn, untreated, 70. Used for bearings.

AA Bronze: Isotropic die-cast bar stock for extremely tough bearing installations and for gears; bhn, 80; ts, 34,000 psi; elong in 2 in., 8 per cent. Furnished in cored and solid bars, fully machined.

Nickel-genuine babbitt: Approximately 85 per cent tin, nickel-treated, free of lead; bhn, 27. Designed to withstand heavy, sustained loads and high heat conditions. It is alloyed for strength and hardness, and will not squeeze out under heavy pressures.

Antifriction metal: Lead-base, less than 10 per cent of tin. For steady high speeds and heavy pressure. Keeps journals in good condition. Recommended also for electric motors above 10 hp. Bhn, 21.8.

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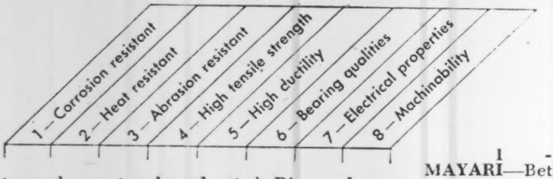
MAKEPEACE Laminated Precious Metals—D. E. Makepeace Co., Attleboro, Mass. Laminated precious metals, consisting of any precious metals bonded to any nonferrous base metals, in strips (coiled), tubing, wire and sheets; for stamping, turning, boring, etc.

Sheet; available in any combination of metals and in ratio, single or double plate or striped. Can be produced as thin as 0.003-in.; in widths from ⅛-in. to 6 in.; and within tolerances of 0.0001-in. to 0.0002-in., depending on material. Available with fine mirrored finish suitable for fine precision parts or decorative pieces. Supplied coiled or flat, depending upon requirements, for any type of part.

Tubing; deep-drawn sheet; dimensional limits lie between approx. 0.015-in. OD to 2 in. OD, with wall thickness as small as 0.005-in., very close tolerances on wall thickness and diameters. Used in electrical industry, for electronic applications, radio parts, delicate instrument assemblies, etc.

Special shapes also available (rectangular, oc-



tagonal, or star-shaped, etc.) Rings, sleeves and jackets can be cut from laminated tubes.

Wire; diameters, 0.005-in. to 0.006-in., depending on material; shaped for use. Available in any shape for instruments, for formed, plated springs, radio electronic parts, and in chemical apparatus when corrosion must be prevented.

See advertisement, Page 302

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MALLIX—National Malleable & Steel Castings Co., Cleveland. Pearlitic malleable iron; for grate bars for sintering machines, elevator buckets, screen plates for pan mills and other castings subjected to heat, abrasion and shock.

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MALLORY—P. R. Mallory & Co. Inc., Indianapolis.

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3 Metal; a copper-chromium-lithium alloy; used extensively for spot, flash and seam welding cold-rolled steel, stainless steel, nickel alloys and Monel metal, silicon bronze alloys, zinc, nickel, silver and other materials employed in applications where a high-strength, high-conductivity material is required; available in rods, bars, strips and castings.

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53B Metal; copper base alloy furnished in castings and forgings only; ts, 60-70,000 psi. Used for heavy-duty butt seam welding wheels, flash welding dies, bearings and current and heat-carrying members in electrical and other machinery.

73 Metal; rough and finished bars, sheets, castings and forgings; containing 95 per cent copper; resists sea water; ts, 110-170,000 psi. Used for bearings and bushings, vibrator arms, springs, spring washers and electrodes for projection welding.

100 Metal; rough and finished bars, castings and forgings, containing 95 per cent copper. Recommended for high loaded small gears, current carrying bearings, springs and other details.

1000 Metal; predominantly tungsten; furnished in finished parts or blanks; ts, 100,000 psi; impact resistance, medium; hardness 32-40 rockwell C; sp gr, 16-9-17.1; nonmagnetic. Heat resistant up to 300 C; abrasion resistance, high. For small counter weights, gyroscope rings, etc.

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MANGANWELD—Lincoln Electric Co., Cleveland. Arc welding electrode that produces deposit of austenitic manganese-nickel-molybdenum steel. Suitable for hard facing austenitic manganese steels parts containing 11-14 per cent manganese, such as crusher parts, valves, turbine runners, pulverizer roll shafts, gathering and loading equipment.

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MARVEL—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.35, W 10.00, Cr 3.50, V 0.50, Si 0.25 and Mn 0.25; furnished in rough bars and billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Comp str, 400,000 psi; impact str, Charpy (unnotched), 40-60 ft-lb; hardness, rockwell C, 46 max; sp gr, 8.2; magnetic; max cont. serv. temp, 1150 F; abrasion resistance high. For wearing parts used at high temperatures and subject to shock, high temperature springs, etc.

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MAX-EL—Crucible Steel Co. of America, New York.

1-B; C 0.20, with high Mn and low Mo; excellent machining and uniformly in carburizing response. Used for automobile parts, machine tool parts, gages, sprockets, etc.

2B; C 0.35-0.45, and otherwise identical in analysis to 1-B. Used in "as-rolled" condition for machine tool spindles, lead screws, racks, worms, piston rods, etc.

3½; for heat-treated parts on machine tools, such as gears, arbors, spindles, etc. Also produces many high-speed steels, tool steels and die steels under many tradenames.

1 - 3 4 - - - -

MAYARI—Bethlehem Steel Co., Bethlehem, Pa.

A; a nickel-chromium series of steels, corresponding to SAE 31XX series, suitable for heat-treated parts. Furnished in various carbon ranges for carburizing, water and oil-hardened parts.

B; a nickel-chromium steel furnished as bolts and sucker rods, having good atmospheric corrosion resistance combined with moderate strength; used in heat-treated condition.

R; a low-carbon, high-strength nickel-chromium-copper-phosphorus structural steel having good resistance to atmospheric corrosion. Used for structural purposes where weight reduction and corrosion resistance are desired.

See advertisement, Page 274

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MAZLO Magnesium Alloys—American Magnesium Corp., Cleveland. Available in sand, permanent-mold and die castings, rolled sheet, extruded bar, shapes and structural sections, and forgings.

AM260; Al 9, Zn 1, Mn 0.2, Mg remainder. Heat-treatable alloy sand and permanent-mold castings. For moving parts on high-speed production equipment and wherever pressure tightness and good strength are needed. Good salt water resistance.

AM265; Al 6, Zn 3, Mn 0.2, Mg remainder. Used for high-strength sand castings requiring good chemical stability.

AM230; Al 10, Si 0.7, Mn 0.2, Mg remainder. Used for pressure die castings for parts requiring light weight and thin sections.

AM263; Al 9, Zn 0.6, Mn 0.2, Mg remainder. Used for pressure die castings for lightweight parts in portable or fast-moving equipment.

AM-C57S; Al 6, Zn 1, Mn 0.15, Mg remainder. Used for extruded bars, tubes and rolled sheet for lightweight applications in general.

AM3S; Mn 1.5, Mg remainder. Used for sheet, strip, extruded shapes, sand castings, and hammer forgings of moderate strength for uses requiring maximum salt water resistance. Suitable for fabricated articles such as aircraft oil tanks and cowlings.

AM-C52S; Al 3, Zn 1, Mn 0.2, Mg remainder. Used for rolled sheet and extrusions of light weight. Good welding and forming characteristics and salt water resistance.

AM-C58S; Al 8, Zn 0.8, Mn 0.15, Mg remainder. Used for hot press forgings for parts under stress, especially for aircraft and aircraft engines.

AM59S; Al 10, Mn 0.15, Mg remainder. Used for extruded shapes in which highest possible hardness and yield strength in tension is required.

AM65S; Al 3.5, Sn 5, Mn 0.5, Mg remainder. Used for hot press forgings of moderate strength and lightness.

See advertisement, Page 145

- 2 3 4 - - - -

MCA—Molybdenum Corp. of America, Pittsburgh.

Ferro-Boron; alloying material in irons and steels. In castings use has been greatly augmented, giving increased strength and machinability, and in the case of malleable iron, ease of annealing.

Molybdenum; alloying element for use in steel and iron: imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

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MCGILL—McGill Mfg. Co., Valparaiso, Ind.

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No. 1: Permanent mold castings: aluminum-bronze alloy; suitable for pump liners, gears, corrosion-resistant castings and parts requiring strength, toughness and minimum weight.

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No. 2: Silicon bronze hydraulic pressure castings; corrosion-resistant; resists heat to 500 F; medium abrasion resistance; ts, 75,000-85,000 psi; bhn, 180.

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No. 4: Brass hydraulic pressure castings; finished castings tolerance of plus or minus 0.005.

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MD METAL POWDERS—Metal Disintegrating Co. Inc., Elizabeth, N. J. Alloy, antimony, aluminum (grain), bismuth, brass, bronze, cadmium, chromium, copper, iron, lead, manganese, molybdenum, nickel, silicon, silver, solder, tin, titanium, tungsten and zinc metal powders; compositions impossible to obtain by conventional methods. For pressing and sintering into variety of powder metal machine parts.

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MEEHANITE—Meehanite Metal Corp., New Rochelle, N. Y., and foundries as listed hereunder. A sorbo-pearlitic iron containing silicon, manganese, phosphorous, sulphur and carbon, composition depending upon mixture and physical constitution as determined by service requirements; twenty-one grades, some of which can be heat treated, and flame hardened, each having a separate and distinct combination of physical properties; available in cast form; for machinery and miscellaneous castings.

Foundries include the following: American Brake Shoe Co., Mahwah, N. J.; Atlas Foundry Co., Detroit; Banner Iron Works, St. Louis; Barnett Foundry & Machine Co., Irvington, N. J.; E. W. Bliss Co., Brooklyn; H. W. Butterworth & Sons Co., Bethayeres, Pa.; Continental Gin Co., Birmingham, Ala.; M. H. Detrick Co., Newark, N. J.; The Elliott Co., Jeanette, Pa.; Farrel Birmingham Co., Ansonia, Conn.; Otis-Fensom Elevator Co. Ltd., Hamilton, Ont.; E. Long Ltd., Orillia, Ont.; General Electric Co., Ontario, Calif.; Valley Iron Works Inc., St. Paul; Greenlee Foundry Co., Chicago; American Laundry Machine Co., Rochester, N. Y.; Cincinnati Milling Machine Co., Cincinnati; Cincinnati Grinders Inc., Cincinnati; Cooper Bessemer Corp., Grove City, Pa., and Mt. Vernon, O.; Crawford & Doherty Foundry Co., Portland, Oreg.; Florence Pipe Foundry & Machine Co., Florence, N. J.; The Newark Stove Co., Newark, O.; Fulton Foundry & Machine Co. Inc., Cleveland; General Foundry Mfg. Co., Flint, Mich.; Stearns-Roger Mfg. Co., Denver, Colo.; Hamilton Foundry & Machine Co., Hamilton, O.; Kanawha Mfg. Co., Charleston, W. Va.; Kinney Iron Works, Los Angeles; Koehring Co., Milwaukee; Henry Perkins Co., Bridgewater, Mass.; Pohlman Foundry Co., Buffalo, N. Y.; Rosedale Foundry & Machine Co., Pittsburgh; Warren Foundry & Pipe Corp., Phillipsburg, N. J.; Vulcan Foundry Co., Oakland, Calif.; Ross-Meehan Foundries, Chattanooga, Tenn.; Traylor Engrg. & Mfg. Co., Allentown, Pa.; Vancouver Engrg. Works, Vancouver, B. C.; Washington Iron Works, Seattle; Washington Machinery & Supply Co., Spokane, Wash.

See advertisement, Page 319

1 2 - 4 5 - 7 8

METAL & THERMIT Welding Electrodes—Metal & Thermit Corp., N. Y. C.

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Stainless; Types 19-9, 347, 18-8 Mo, 25-20, 25-20 N, and 310 AC-DC. For welding food chemical and refinery processing equipment, acid container linings, valve seats, turbine blades, heat exchangers, dies, etc.

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Chrome-Moly Types; Type 1110, 1113, 2110, 2113, 2115, 4110, 4113, 4210, and 4213. For welding chrome-moly and other high-strength piping and pressure vessel cast fittings.

Copper-Aluminum (Bronze) Types: AB-12, AB-16, AB-20, AB-25, and AB-30. For built-up bearing surfaces, bronze casting repairs, repair of motor end rings, piston rods, pump parts, locomotive guides, parts of dissimilar materials, ship propellers, marine fittings, etc.

Copper-Tin (Bronze) Type; AB-57. Uses similar to those of above.

Types A, AWL, CF, CW, FHP, F, HTS, M, MA, N, O, RC, U, 90, 7015 B, 8015 Q, are for general machine-part fabrication and repair including drive shafts, auto springs, machine bases, etc.

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METALINE—R. W. Rhoades Metaline Co. Inc., Long Island City, N. Y. Lubricating insert plugs of several diameters and lengths and in varied compositions for rendering bronze bearings and bushings oilless. Also bronze bearings complete in which Metaline plugs are inserted, furnished as finished bearings.

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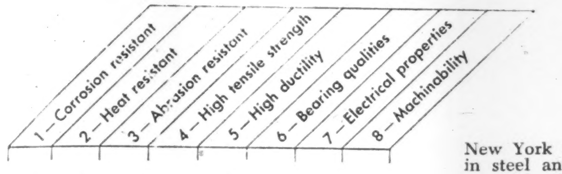
MICHIGAN Seamless—Michigan Seamless Tube Co., South Lyon, Mich. Cold-drawn seamless tubing of standard carbon and alloy steels and of special alloys to customers' requirements. Available in rounds, squares and special shapes. For aircraft, pressure and mechanical uses.



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MICROROLD—Washington Steel Corp., Washington, Pa. Standard stainless steels in Types 302, 304 and 430 for household machinery, heating and ventilating, automobile, materials handling, etc. For property and application data, see "Stainless Steels" listing elsewhere in this section.

1 2 - - - - - -
MIDVALE Steels—The Midvale Co., Nicetown, Philadelphia 40. Heat and corrosion resisting steel castings (stainless steels), and bar steel, carbon, high speed and alloy tool steel, also stainless bars.

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MIN-OX—The Binney Castings Co., Toledo 7, O. Heat-resistant castings for molds, valves, plungers, neck rings and other necessary mold parts for production of glass. Also known as Binney Metal.

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MOCCASIN—Moccasin Bushing Co., Chattanooga, Tenn. Various bronze alloys furnished as rough castings solid or cored bars, and plain and special bushings. Also [illegible] bushings of SAE 64 (80-10-10) bronze.

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MOGUL BABBITT—Federal-Mogul Corp., Detroit.

Mogul alloy genuine babbitt; made from tin, antimony and copper, virtually lead free; hard, tough alloy; high tensile strength; suitable for die-cast and hand-poured bearings. Used for high-speed automobile and aircraft engine, steel and bronze back main and connecting-rod bearings, trucks, tractors, high-speed machinery, planers, etc.

Mogul bearing metal; general all-purpose babbitt for bearings requiring toughness. Used for machinery bearings, stationary gas engines paper mill rolling mill, rubber plant and brick machinery.

407 nickel babbitt; varying slightly from Mogul genuine babbitt alloy. For applications where speed is fairly high and bearings are large, that is, 1/16th-inch or more in thickness. Used in woodworking machinery and other heavy-duty types.

408 special babbitt (copper-hardened); originally produced for electric railway armatures. now used for special bearing applications· has great durability and will stand up under hard wear. Used in motor pumps, motor shafts, rock crushers, forming presses.

Duro antifriction metal; while softer and less tough than Mogul bearing metal (above), compares favorably with lead-base general purpose babbitts. Used for flour mill, laundry, canning and bottling machinery, pump packing. slow-moving pulleys, etc.

Special "B"; a lead and antimony alloy; free of usual nonbearing ingredients. Used for slow-speed bearings and heavy line shafting.

See advertisement, Page 299

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MOLEX—Metal & Thermit Corp., New York 5. Arc welding electrode for low-alloy. high-strength machine parts. Weld deposit: Ts, 70-75 000 psi; ys. 57-66,000 psi; elong in 2 in., 22-31 per cent.

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MOLIN METAL—American Art Alloys, Inc., Kokomo, Ind. Aluminum bronze alloys furnished as permanent-mold castings and forgings to specifications.

No. 2; in untreated condition; Ts. 60 000 psi; elong in 2 in., 9 per cent; bhn, 130-140; weldability, good: abrasion resistance, high. For welding machine fixtures, bearings, etc.

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No. 2½; In heat-treated condition: Ts, 62 000 psi: elong in 2 in., 3.5 per cent; bhn, 180-200; weldability, good; abrasion resistance, high. For welding machine fixtures, bearings. acid bath hooks, etc., which require higher hardness than that offered by Molin Metal No. 2.

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No. 3; In untreated condition: Ts. 59,900 psi; elong in 2 in., 1 per cent; bhn, 200 to 220; weldability, fair; abrasion resistance, high. For wiping dies, die plates, welding machine fixtures, etc.

1 2 3 4 - - - -
MO-LYB-DEN-UM — Climax Molybdenum Co., New York 18. An alloying element for use in steel and iron. Imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

See advertisement, Page 257

- - 3 - - - - -
MO-MANG — American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill, Mn 12-14, C 0.7-0.9 with molybdenum. Welding-rod for build-up welding on 13 per cent manganese steel and other ferrous castings which are subject to severe impact and abrasion. These rods form a sound, dense deposit of extremely tough steel, which will withstand severe impact and work-hardens to from 450 to 500 bhn.

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MO-MAX—The Cleveland Twist Drill Co., Cleveland 14. A high-speed steel, in rough bars or billets, finished rods or bars, wire and sheets, for hot forging, turning, boring, welding, etc. Resists heat to 1100 F; high abrasion resistance; high tensile strength; good bearing properties; sp gr about 7.95; good weldability; bhn, untreated, 220; heat-treated, 700. For use where great strength and wear resistance up to temperatures of 1000 F are required, such as gears, cams, guides, wearing plates, etc. Licensees are: Allegheny Ludlum Steel Co., Atlas Steels Ltd. (Canada), Bethlehem Steel Co., Braeburn Alloy Steel Corp., Carpenter Steel Co., Crucible Steel Co. of America, Henry Disston & Sons Inc., Halcomb Steel Div., Crucible Steel Co. of America, Jessop Steel Co., Latrobe Electric Steel Co., Universal-Cyclops Steel Corp., Vulcan Crucible Steel Co., Simonds Saw & Steel Co., Vanadium-Alloys Steel Co., Columbia Tool Steel Co., Firth Sterling Co., and The Midvale Co.

See advertisement, Page 315

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MONARCH—Monarch Alloys Co., Ravenna, O. High-lead bronzes in several different grades, produced by water-chilled process; furnished in rough bars in 2-ft lengths. Good bearing qualities and good machinability. Also produce bronze and aluminum sand castings.

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MONEL — The International Nickel Co. Inc., New York. High nickel-copper alloys in wrought and cast forms as follows:

Monel Wrought Forms; various tempers of rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, and seamless tubing. Property ranges: Ts, 70-170,000 psi; ys, 25-160,000 psi; elong in 2 in., 50-1 per cent; bhn, 110-375. Corrosion resistance, high. For propeller shafts, pump shafts and rods, impellers, bolts, rivets, etc., orifice plates, tanks, electrical contact parts, springs, carburetor parts, strainers, screens, filters, etc.

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Monel Castings; In untreated state: Ts, 65-90,000 psi; ys, 32-40,000 psi; elong in 2 in., 45-25 per cent; bhn, 125-150. Slightly magnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 800 F (under load); corrosion resistance, high. For pump casings, impellers. filter plates, valve bodies, trim, bushings. fittings. Widely used where corrosion resistance is an important factor as in laundry, pickling, tanning, marine, chemical, oil-processing, paint and food-processing equipment.

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"K" Monel; furnished in rod and bar, strip and wire in various forms and tempers. Range of properties: Ts, 90-200,000 psi; ys, 40-145,000 psi; elong in 2 in., 45-2 per cent; bhn, 140-320. Corrosion resistance, high. For marine pump shafts. wearing sleeves, oil-pump drop and seat-valves, valve disks and pump rods, ball-bearing races, balls and cones, roller chain, link studs, check-valve balls, wire springs, etc.

"KR" Monel Wrought Forms; available in rod and wire only. Composition, same as "K" Monel. Has better machinability than K.

"R" Monel Wrought Forms; furnished in rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, seamless drawn tubing. Range of properties: Ts, 65-170,000 psi; ys, 25-160.000 psi; elong in 2 in., 50-1 per cent; bhn, 110-375. Corrosion resistance, high. Machinability, better than Monel. For parts requiring good corrosion and abrasion resistance combined with free-cutting qualities.

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"H" Monel Castings; Untreated: Ts, 90-115,000 psi; ys, 60-80 000 psi; elong in 2 in., 20-10 per cent; bhn, 175-250; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp, 800 F (under load); corrosion resistance, about same as Monel. For parts similar to those for which regular Monel is suitable, but where better abrasion and erosion resistance is required, plus higher strength, as for steam nozzles.

"S" Monel Castings; Heat treated: Ts, 110-145,000 psi; ys. 80-115,000 psi; elong in 2 in., 4-1 per cent; bhn, 300-375; nonmagnetic; weldability, good; abrasion resistance, high; max cont. serv. temp, 1100 F (under load); corrosion resistance, about same as regular Monel. Parts, similar to those for which regular Monel is suitable, but where top resistance to galling and erosion are needed, as for valve seats, etc.

See advertisement, Page 143

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MORAINE—Moraine Products Div., General Motors Corp., Dayton, O. Rolled bronze split-type bearings and bushings for automobiles, electric motors and farm implements.

See advertisement, Page 151

1 - 3 - - 6 - -
MORAINE POROUS METAL—Moraine Products Div., General Motors Corp., Dayton, O. Filtering and diffusing material, product of powder metallurgy in bronze, and other metals; provides high flow rates, low flow resistance; used in fuel and lubricating systems, instruments, breathers, burners, separators, etc.

See advertisement, Page 151

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MOSIL—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.55, Si 1.90, Mn 0.85, Cr 0.25, Mo 0.33; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings, and drill rod; for permanent-mold casting, precision casting, machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: hardness, rockwell C, 62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels, dogs, shears, etc.

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MRCO METAL POWDER—Metals Refining Co., Hammond, Ind. Metal powders furnished in the following grades:

40 RL; Cu 99.4; all passing in a 40-mesh sieve, not over 20 per cent passing a 200-mesh screen; has apparent density of 2.5 grams per cu cm. Used in commutator brushes, chemical porous filters, catalyzers, and pressed metal compositions.

100 RXA; Cu 99.4; all passing a 100-mesh screen; not over 45 per cent passing a 325-mesh screen; has apparent density of 2.7 grams per cu cm. Used in porous metal bearings, intricate pressed metal shapes, electrical commutator brushes, etc.

150 RXA; Cu 99.4; all passing a 150-mesh sieve, not over 75 per cent passing a 325-mesh sieve; has apparent density of 2.7 grams per cu cm. For same applications as 100 RXA.

200 RL; Cu 99.4; all passing a 200-mesh sieve, and not less than 85 per cent passing a 325-mesh sieve. Used in chemical equipment, special commutator brushes, porous bearing compositions; also has advantages for copper brazing and coating welding rods.

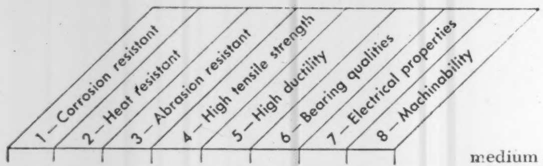
500 RL; Cu 99.4; all passing a 325-mesh sieve, and substantially all particles are less than 15 microns in diam. For use where extremely fine particle size is desired, in brazing and coating, as clutch facings, etc.

I-100; Fe 96 min; all passing a 100-mesh sieve; and 25-45 per cent passing 325-mesh sieve; has apparent density of about 1.8-2.0 grams per cu cm. For pressed parts such as clutch facings, gears, filters, etc.

I-120; Fe 96 min; all passing 100-mesh sieve and 30-50 per cent passing 325 mesh. Has apparent density of 2.3-2.5 grams per cu cm. Same uses as I-100.

I-147; Fe 96.5 min; all passing 40 mesh sieve and 10-20 per cent passing a 325-mesh sieve. Has apparent density of 1.8-2.0 grams per cu cm. Same uses as I-100.

I-247; Fe 97 min; apparent density 2.65-2.85 grams per cu cm; all passing a 40-mesh sieve with 10-20 per cent passing 325-mesh sieve; hydrogen-annealed for pressed ferrous metal compositions and electrical parts requiring high priority iron.



I-257; Fe 96 min; all passing 100-mesh sieve; 55-70 per cent passing 325-mesh sieve. Used where extremely fine particle size is required.

I-297; Fe 97 min; apparent density 1.9-2.1 grams per cu cm; all minus 100-mesh sieve, with 20-30 per cent passing 325-mesh sieve; hydrogen-annealed. Used for same purpose as I-247.

I-312; Fe 97.5; apparent density 1.9-2.1 grams per cu cm; all passing 40-mesh sieve; 15-25 per cent passing 325-mesh sieve; hydrogen annealed. Used for same purpose as I-247.

100B; 99.7 per cent Pb; all passing 100-mesh sieve; not over 70 per cent passing 325-mesh sieve; apparent density, 5.6 grams per cu cm. Used for brake linings, metallic clutch facings, porous bearings, metallic filters, X-ray rubber sheets, X-ray shields and special alloys.

F; 99.7 per cent Pb; all passing a 200-mesh sieve and substantially all particles less than 20 microns in diam. Used for same applications as 100B.

1 - 3 4 - - - -
MUELLER 600 Bearing Metal—Mueller Brass Co., Port Huron, Mich. Cu 56-60, Pb 0.5 max, Mn 1.25-3.5, Al 0.5-2, Si 0.5-1.2, Fe 0.6 max, and remainder Zn. Sold as extruded and drawn, and rods and bars, and as die forgings from rod. Ts, 70-85,000 psi; ys, (½ per cent extension) 45-50,000; elong in 2 in., 20 to 10 per cent for die forgings. Sp gr 8.071; conductivity about 12 per cent of copper; nonmagnetic; good corrosive resistance, against sea water. Used as low speed heavily loaded bearings as it withstands damage from lubricants carrying considerable sulphur compounds. Also used for high-speed bearings on hardened mating surfaces, cam faces and machine parts subject to wear, such as pump rods and shafts, and forged connecting rods for high-speed.

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MUMETAL—Allegheny Ludlum Steel Corp., Brackenridge, Pa. A very high permeability nickel-copper-iron alloy, that must be very high-temperature, dry-hydrogen annealed after fabrication. Sold principally in form of sheet, strip, bar, and laminations, also shields. For special electrical instruments and transformers requiring highest performance.

See advertisement, Page 313

1 - - 4 - - - 8
MUNTZ Metal—Revere Copper & Brass Inc., New York 17. Cu 60, Zn 40; furnished in finished bars or rods, tubing, sheet and plate, for machining, hot working. and arc, gas and resistance welding. In cold-worked state: ts, 85 000 psi; ys, 60,000 psi; elong in 2 in.. 5 per cent: endurance limit (completely reversed bending), 25,000 psi; hardness, 85 rockwell B; sp gr, 8.30; max cont. serv. temp, 400 F. For condenser heads, perforated metal parts, valve stems, etc.

See advertisements, Pages 263-264

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NA, NA-1, NA-2—National Alloy Steel Division, Blawnox, Pa. Alloy steels having varying percentages of nickel and chromium.

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NACO—National Malleable & Steel Castings Co., Cleveland. Special processed cast steel; for service where heavy blows and constant friction require a material that combines great strength, toughness and resistance to wear. Used in chains for steam shovel, dragline, draft gears, railway equipment.

1 - - - - 6 7 -
NATIONAL—National Molded Products Inc., St. Marys, Pa. Cu 90, Sn 10; furnished in powder. Nonmagnetic; corrosion-resistant; heat-resistant to 400 F; abrasion resistance, high. For bearings or intricate parts.

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NATIONAL Graphitic Steel—National Malleable & Steel Castings Co., Cleveland. High-strength steel furnished in castings. Has medium abrasion resistance; ts, 75,000 psi min; can be flame hardened; avg bhn, 200. Used for automotive and other medium-size castings requiring high strength and good machinability.

NATIONAL METALS—National Bearing Div., American Brake Shoe Co., St. Louis 10. Various nonferrous centrifugal and precision castings, babbitt metals and precision bearings. Castings produced to specification.

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NATIONAL-STANDARD — National Standard Co., Niles, Mich.

Wire braids flat and tubular of steel or other metal.

Tapes and specialized wire products for tire beads, steam hose armor, reinforcement for oil well drilling hose, braided covering for flexible tubing, aircraft and tank radio shielding.

Standard wire for reinforcing flat and V-belts.

Braided covering for electrical cables.

Drawn wire in small sizes down to 0.002-in. of steel, aluminum, brass, Monel, nickel silver, stainless steel, phosphor bronze and other alloys.

See advertisement, Page 138

1 - - 4 5 - - 8
N-A-X—Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Mich.

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9100 Series; C 0.1-0.7, Mn 0.6-0.75, P 0.040 max, S 0.05 max, Si 0.6-0.9, Cr 0.5-0.65, Mo 0.1-0.2, and Zr 0.05-0.15. Furnished in rough bars or billets, finished rods or bars, strips (coiled), sheets and plates, for forging, stamping, turning, boring, etc. Recommended heat treatment: Quench and draw—carburizing grades treated by regular conventional methods.

High tensile; C 0.12, Mn 0.70, Si 0.80, Cr 0.60, S 0.030, P 0.025, and Zr 0.10. Furnished in rough bars or billets, finished rods or bars, strips (coiled), tubing, wire, sheets and plates for stamping and welding. No subsequent treatment needed after hot working. Good stability and ductility permit it to be cold-formed; good impact resistance; high fatigue resistance; good welding properties. Used for machine parts where high torsional properties, high tensile strength and resistance to fatigue and notch impact at normal and subzero temperatures are required.

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NELOY—National-Erie Corp., Erie, Pa. Medium manganese cast-steel and medium manganese plus molybdenum alloy content cast steels; rough, finished, machined or flame hardened. High strength and hardness due to combination of alloying and special hardening. Has high abrasion resistance. Used for various applications in rolling mills and steel works equipment, over-head traveling cranes, power shovels, drag lines, etc.

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NEW JERSEY ZINC—The New Jersey Zinc Co., New York.

Brass Powders; all common brasses furnished in powder metal. Ts, 29-35,000 psi; comp str, 31-43,000 psi; ys, 8500-18,800 psi; elong in 2 in., 11-50 per cent, impact str, 11-27 ft lb (Charpy); bhn, 35-51.

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Spherical Copper Powder; resists corrosion caused by oils and lubricants. Used for filters.

See advertisement, Page 166

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NEY-ORO G—The J. M. Ney Co., Hartford, Conn. Gold-platinum-silver-copper alloy in wire, sheets, coiled strips, and plates; for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: Ts, 160,000 psi; ys, 154,000; elong, 6 per cent; impact resistance, high; bhn, 280; non-magnetic; weldability, good; abrasion resistance, medium. For pivots, small bearings, springs and electrical contacts.

1 2 - - - - 7 -
NICHROME—Driver-Harris Co., Harrison, N. J. Acid and alkali, heat-resistant alloy consisting of Ni 60, Fe 25, Cr 15. Resists heat to 2000 F. Recommended for furnace parts, acid dipping baskets, and filter screen.

A; Ni 62, Cr 15; heating element material also for electrical devices, including rheostats, potentiometers, seamless tubing, etc.

B; as an addition to cast iron; sold in ratios of 5 to 2½ parts of Ni to 1 part of Cr.

V; Ni 80, Cr 20; heating element material; also in sheets for welded tubing.

Cast Nichrome; for furnace parts, pyrometer protection tubes, conveyor castings and carburizing containers. Sheet Nichrome S; Ni 27, Cr 15. Used for various applications.

1 - - - 5 - - -
NICKELOID—American Nickeloid Co., Peru, Ill. Nickel bonded to zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and forming without marring prefinish.

1 2 - - - - - -
NICLOY Steel Tubes—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

No. 3½; C 0.20 max, Mn 0.30-0.60, P 0.040 max, S 0.040 max, Si 0.35 max, Ni 3.25-3.75. Heat and corrosion-resistant tubing; good creep strength. Heat treated: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 40 per cent; bhn, 165; weldability, good. For low-temperature equipment, etc.

No. 5; C 0.14 max, Mn 0.30-0.60, P 0.040 max, S 0.040 max, Si 0.35 max, Ni 4.75-5.25. Heat and corrosion-resistant tubing; good creep strength; Heat-treated; Ts, 90,0000 psi; ys, 65,000 psi; bhn, 175; weldability, good; corrosion resistant to alkaline media. For chemical processing equipment and equipment operating at subzero temperatures.

No. 9; C 0.10 max, Mn 0.30-0.60, Si 0.15-0.30, Ni 8-10; heat and corrosion-resistant tubing; good creep strength. Heat treated: Ts, 110,000 psi; ys, 85,000 psi; elong in 2 in., 35 per cent; bhn, 230; magnetic; weldability, good; corrosion resistant to alkaline and mixed organic acid solutions. For black liquor and alkali evaporation; also for subzero temperature service down to —320 F.

See advertisement, Page 265

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NICLOY Tubing—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Nos. 3½ and 5; 3.5 per cent and 5 per cent nickel-steel seamless tubing respectively; have good corrosion resistance to various alkaline media and good resistance to embrittlement at subzero temperatures (down to —150 F). Ts, 60,000 psi, min; ys, 30,000 psi, min; elong in 2 in., 30 per cent, min. Used in black liquor recovery in pulp and paper mills, also in handling crude oil containing substantial amounts of salt water and hydrogen sulphide.

No. 9; a nickel-steel pressure tubing with good physicals at temperatures down to —320 F. Ts, 80,000 psi, min; ys, 50,000 psi, min; elong in 2 in., 20 per cent, min. Used for piping in oil refinery and in the chemical industries. Also suitable for tubing for black liquor and caustic solution evaporation and for alkaline-phenol solution work.

See advertisement, Page 265

1 - - 4 - 6 - -
NICUITE—A. W. Cadman Mfg. Co., Pittsburgh. Nickel-bronze; Sn 10, Ni 3.5, Zn 2.5 trace of P, balance Cu; high compressive strength. For bearings operating at slow or medium speeds under extreme pressures.

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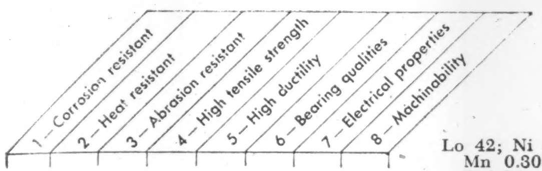
NI HARD Castings—International Nickel Co. Inc., New York. A series of abrasion resistant castings to specifications, as follows:

- - 3 - - - - -
Type 1 Regular Sand Cast: Total C 3-3.6, Si 0.50-0.60, Mn 0.40-0.60, S 0.15 max, P 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50. Heat treated: Ts, 40-50,000 psi; bhn, 550-650; magnetic; weldability, poor; abrasion resistance, very high. For parts such as ball-mill liners, pump parts, crusher jaws, pry-mill knives and other abrasion-resistant parts of mining, power, cement, ceramic, paint, and foundry equipment.

Type 1 Regular Chill Cast; Composition same as above except Si, which is 0.60-1.00. Heat treated: Ts, 50-60,000 psi; bhn, 600-725; magnetic; weldability, poor; abrasion resistance, very high. For same type parts for which Type 1 Regular Sand Cast is suitable.

- - 3 4 - - - -
Type 2, High-Strength, Sand Cast; total C 2.90 max, Si 0.50-0.80, Mn 0.40-0.60, S



0.15 max, P 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50. Heat treated; Ts, 45-55,000 psi; bhn, 525-625; magnetic; weldability, poor; abrasion resistance, very high. Parts same as for the Regular Sand Cast type, but for greater strength and toughness.

Type 2, High-Strength, Chill Cast; Composition same as Type 2, Sand Cast, except silicon, which is 0.60-1.00. Heat treated; ts, 60-75,000 psi; bhn, 575-675; magnetic; weldability, poor; abrasion resistance, very high. For parts same as those for which Regular Ni Hard is suitable, but where greater strength and toughness are required.

See advertisement, Page 143

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NIKRO M—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.70, Mn 0.55, Si 0.30, Cr 0.85, Ni 1.40, and Mo 0.40; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing, brazing and forging. Hardness, rockwell C, 62 max; magnetic; abrasion resistance, medium. For spindles, etc.

1 2 - - - - 7 -

NILVAR—Driver-Harris Co., Harrison, N. J. A 36 per cent Ni steel having the lowest coefficient of expansion to 392 F of an alloy. Used for thermostatic controls in heating apparatus such as electric ovens, laboratory ovens, gas ovens, oil burners, and house heating apparatus.

1 2 3 4 - 6 - -

NI-RESIST—International Nickel Co. Inc., New York. Various grades of heat and corrosion-resistant castings, as follows:

1 2 - - - 6 - -

Type 1; Total C 3.00 max, Si 1-2.5, Mn 1-1.5, Ni 13.5-17.5, Cu 5.5-7.5, Cr 1.75-2.5. Untreated; Ts, 25-30,000 psi; bhn, 130-160; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont. serv. temp, 1300 F; good corrosion resistance. For pipes, pump parts, heat exchangers, etc., where corrosion resistance, elevated-temperature resistance, or high electrical resistance is required.

Type 2; Total C 3.00 max, Si 1-2.5, Mn .80-1.5, Ni 18-22, Cu 0.50 max, Cr 1.75-2.5. Untreated: Ts, 25-30,000 psi; bhn, 130-160; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont. serv. temp, 1300 F. For same type parts as Type 1.

Type 3; Total C 2.75 max, Si 1-2, Mn 0.40-0.80, Ni 28-32, Cu 0.50 max, Cr 2.5-3.5. Ts, 25-35,000 psi; bhn, 120-150; magnetic; weldability, fair; max cont. serv. temp, 1300 F. For corrosive applications or moderately high-temperature applications involving severe thermal gradients.

Type 4; Total C 2.60 max, Si 5.5-6.5, Mn 0.40-0.80, Ni 29-32, Cu 0.50 max, Cr 4.5-5.5. Ts, 20,000 psi; bhn, 175; slightly magnetic; weldability, fair; abrasion resistance, medium; max cont. serv. temp, 1500 F. For stove tops, food processing equipment where stain resistance is desired.

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Type 5 (Monovar Iron); Total C 2.40 max, Si 1-2, Mn 0.40-0.80, Ni 34-36, Cu 0.50 max, Cr 0.10 max. Ts, 20-25,000 psi; bhn, 100-125; magnetic; weldability, fair; for machine tool gages, scientific and optical instruments, glass molds, paper dies and equipment where low thermal coefficient of expansion is required.

See advertisement, Page 143

1 2 - 4 - - - -

NIREX—Driver-Harris Co., Harrison, N. J. Acid-resisting material with tensile strength, annealed, up to 95,000 psi; spring temper 180,000; supplied in finished rods or bars, wire, sheets and strip; also can be fabricated by sand casting. For use where corrosion and heat resistance, and spring properties will be useful.

NI-SPAN C—H. A. Wilson Co., Newark 5, N. J. A titanium-chromium-nickel alloy having a constant modulus, adjustable through heat treatment.

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NI-SPAN—International Nickel Co. Inc., N. Y. C. Low and high-expansion wrought alloys as follows:

Lo 42; Ni 40.5-42.5, Ti 2.2-2.6, C 0.06 max, Mn 0.30-0.60, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-195,000 psi; ys, 40-165,000 psi; elong in 2 in., 30-5 per cent; bhn, 140-385; is fairly magnetic; weldability, good. For low-expansion element in thermostats, measuring tapes, special springs, instrument-frame glass-to-metal seals, etc.

Lo 45; Ni 44.5-46.5, remainder same as Type Lo 42. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-180,000 psi; ys, 40-150,000 psi; elong in 2 in., 30-5 per cent; bhn, 140-370; is fairly magnetic; weldability, good. For same types of parts for which Ni Span Lo 42 is suitable.

Lo 52; Ni 51-53, balance same as for Type Lo 42. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip, and wire. Ts, 85-150,000 psi; ys, 35-130,000 psi; elong in 2 in., 30-5 per cent; bhn, 125-350; is fairly magnetic; weldability, good. For same types of parts for which Ni Span Lo 42 is suitable.

C; Ni 41-43, Ti 2.2-2.6, Cr 5.1-5.7, C 0.06 max, Mn 0.30-0.60, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars and billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-200,000 psi; ys, 35-180,000 psi; elong in 2 in., 40-7 per cent; bhn, 145-395; is less magnetic than Ni Span Lo types; weldability, good. A constant-modulus alloy for springs used in accurate scales, tuning forks, bourdon tubes, diaphragms for altimeters, strain gages.

Hi; Ni 28-30, Ti 2.2-2.6, Cr 8-9, C 0.06 max, Mn 0.30-0.80, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Furnished in rough bars or billets, finished rods and bars, straight and coiled strip and wire. Ts, 80-180,000 psi; ys, 35-130,000 psi; elong in 2 in., 30-8 per cent; bhn, 140-370; nonmagnetic to —130 to —320 F (depending on cold-work and heat treatment); weldability, good; abrasion resistance, medium. For high-expansion elements in thermostats, etc.

See advertisement, Page 143

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NI-TENSYLIRON—International Nickel Co. Inc., New York, and licensees Ni 1-4, total C 2.5-3.15, Si 1.2-2.75, Mn 0.5-0.9. For machine tool castings, diesel engine housings, cylinder blocks, pistons, etc.

See advertisement, Page 143

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NITRALLOY—Nitralloy Corp., New York, controls nitriding process and licenses under which alloy is produced. A chromium-molybdenum-aluminum steel capable of developing extreme hardness through nitriding; for cams and camshafts, gears, pump parts, splined shafts, cylinder liners, etc. Licensees include Allegheny Ludlum Steel Corp., Bethlehem Steel Co., Crucible Steel Co. of America. Firth-Sterling Steel Co., Republic Steel Corp., Rotary Electric Steel Co., The Timken Roller Bearing Co., Vanadium Alloys Steel Co., Copperweld Steel Co., Atlas Steels Ltd., The Babcock & Wilcox Tube Co., and Carnegie-Illinois Steel Corp.

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NOVO SUPERIOR High-Speed Steel—H. Boker & Co. Inc., N. Y. C. An 18-4-1 (W, Cr, V) steel with maximum red hardness and wear resistance. Used for punches, broaches, cutters, knives, reamers, drills, etc.

1 2 3 - - - - -

NUREX—National Malleable & Steel Castings Co., Cleveland. A chromium-manganese-carbon alloy furnished in castings. Resists corrosion caused by dilute aqueous solutions and acids (except phosphoric). Resists heat to 1700 F. Abrasion-resistant. Used for mill balls, lining and similar purposes.

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ODIS—Old Dominion Iron & Steel Corp., Richmond 3, Va. Staybolt wrought iron, solid, furnished in rods or bars for cold working. Has high ductility, high corrosion resistance and good machinability. For staybolts of all types.

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OH-38 Aluminum Alloy—Oscar W. Hedstrom Corp., Chicago. Fe 1.25, Si 1.5, Cu 3, Zn 10 (nominal); furnished as castings. No heat treatment is necessary. Ts, 35,000 psi; ys, 29,000 psi; elong, 2.5 per cent; bhn, 98; sp gr, 2.88 (0.106 lb per cu in.); nonmagnetic; weldability, good. Resists corrosion caused by vegetable juices; heat-resistant to 900 F; abrasion resistance, high. For all types of mechanical machinery and devices.

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OHMALOY—Allegheny Ludlum Steel Corp., Brackenridge, Pa. A steel for high electrical resistance applications, such as motor starters, crane motor controls, and mine locomotive controls. Available in all forms. Approx. analysis—Cr 12, Al 4½, Fe bal.

See advertisement, Page 313

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OLD DOMINION Iron—Old Dominion Iron & Steel Corp., Richmond 3, Va. Staybolt wrought iron, hollow-rolled. Has high corrosion resistance, high ductility, and good machinability. For various types of staybolts.

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OLDS Bearing Bronze—Olds Alloys Co., South Gate, Calif. Copper-nickel-tin-lead-zinc alloy (high lead); furnished as sand castings. In untreated state: Ts, 25,000 psi; comp str, 17,000 psi; ys, 16,000 psi; elong in 2 in., 10 per cent; hardness, rockwell B, 50; sp gr, 0.33; nonmagnetic; max cont. serv. temp, 350 F; abrasion resistance, medium. For bushings and bearings of all types.

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OLDSMOLOY—Olds Alloys Co., South Gate, Calif. Chromium-molybdenum bronze (color white); furnished as sand castings. In untreated state: Ts, 80,000 psi; ys, 47,000 psi; bhn, 160; nonmagnetic; weldability, good; resists corrosion caused by various common acids as well as saline solutions; max cont. serv. temp, 600 F; abrasion resistance, medium. For use in food and chemical machinery of all kinds.

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OILITE—Chrysler Corp. Amplex Div., Detroit 31. Oil-cushion, heavy-duty bronze bearings containing one-third oil by volume. Used extensively in aircraft, automobiles, farm implements, home appliances, electrical equipment, textile machinery, etc. Filters, Cored, Bar and Sheet Stock.

Super-Oilite; a porous oil-cushion extreme pressure self-lubricating iron alloy bearing. Allowable bearing-load, 30,000 psi at zero velocity. Furnished as finished bearings or machine parts of irregular shapes, also in bars and plates; excellent bearing properties; high oil content, strength and ductility.

Super-Oilite 16; a porous oil-cushion extreme high-pressure self-lubricating bearing for high load and low velocity bearing applications; has high oil content, extreme hardness with an allowable bearing load exceeding 100,000 psi at zero velocity.

Iron-Oilite; a porous pure iron self-lubricating bearing, oil-cushioned, copper free. Resists corrosive effects of sulphur, its compounds and similar agents. Used especially for bearings in pumps, etc.

Aluminum-Oilite; a porous lightweight oil-cushion bearing. Eliminates galvanic action with surrounding aluminum housings. Used as bearings for aircraft controls and wherever lightness is important.

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OILWAY Die Steel—H. Boker & Co. Inc., N. Y. C. C 0.94, Si 0.33, Mn 1.23, W 0.57, Cr .44. Furnished in bars, drill rods and forgings. For all types of dies, gages, reamers, broaches and punches.

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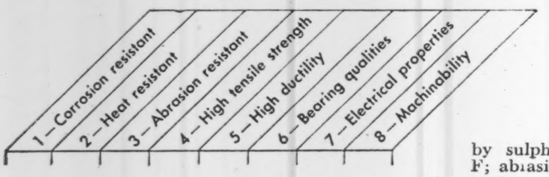
OLYMPIC BRONZE—Chase Brass & Copper Co., Waterbury 91, Conn.

Type A; Cu 96, Si 3, Zn 1; ts, 55-150,000 psi; bhn, 70-200. Resists corrosion due to saline, acid and alkaline solutions. Used for welded structural parts, bolts, nuts, tubing, tie rods, etc.

Type B; Cu 97.5, Si 1.5, Zn 1; ts, 45-90,000 psi. Resists corrosion due to saline, acid and alkaline solutions. Used for bolts, nuts, pipe and tubing.

1 - 3 - 5 - 7 -

OREIDE—Scovill Mfg. Co., Waterbury, Conn. Cu 90, Sn .5, balance Zn; in finished rods or bars, tubing, wire, sheets and strips (coiled); for stamping, turning, boring, etc., into machine parts. Medium abrasion resistance; ts, 95,000 psi (hard drawn or rolled); sp gr, 8.8; bearing properties, fair; electrical properties, fair; recommended heat treatments, anneal at 975-1025 F; spring prop-



erties good. Used primarily for spring contacts and switch parts.

See advertisement, Page 295

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OSTUCO—Ohio Seamless Tube Co., Shelby, O. Precision tubing; seamless and electric-weld. Formerly known as Ohio Specialty Quality tubing.

See advertisement, Page 258

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OTISCOLOY—Jones & Laughlin Steel Corp., Pittsburgh 30. A high-tensile steel, light in weight. good weldability and formability; resistant to abrasion and corrosion. For use in cars, trucks, buses, mine cars, etc.

See advertisement, Page 253

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OXWELD—Linde Air Products Co., The, New York.

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No. 1; welding rod for steel giving welds of high tensile strengths up to 70,000 psi.

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No. 7; drawn iron welding rod giving welds where high tensile strength is not a factor.

No. 9; cast iron rod (round) for gray iron castings.

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No. 23; welding rod for cast aluminum and aluminum alloys, giving high tensile strength.

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No. 25M; bronze welding rod having brinell hardness of 96 and high tensile strength.

No. 28; a columbium bearing welding rod suitable for 18-8 stainless steel.

See advertisement, Page 153

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PAGE Wire—Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa. Low and high-carbon steel wire, also ingot iron wire, and stainless steel wire; furnished in various strengths and hardness numbers; magnetic and nonmagnetic; heat resistant to 2150 F (stainless). For various uses.

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PAINTGRIP Cold-Rolled—American Rolling Mill Co., Middletown, O. Iron or steel sheets or coils mill-treated with an electrolytic "flash" of zinc and then bonderized. Will draw, form, weld and solder readily. Eliminates bonderizing after fabrication. For housings, trim, guards, etc.

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PALINEY—The J. M. Ney Co., Hartford, Conn.

No. 6; palladium-platinum-silver-copper-nickel alloy; in wire, sheets, coiled strips, and plates for stamping, turning, boring, welding and soldering. Mechanical properties in heat-treated state: Ts, 170,000 psi; ys, 127,000; elong, 15 per cent; bhn, 270; sp gr, 10.9; nonmagnetic; abrasion resistance, medium. Used for pivots, small bearings, springs, electrical contacts etc.

No. 7; similar to No. 6 in analysis with the addition of gold; available also in the same form. In heat-treated state: Ts, 180,000 psi; ys, 148,000; elong 9 per cent; impact resistance, high; bhn, 280; sp gr, 11.9; nonmagnetic; weldability, good. For same uses as foregoing.

1 2 3 4 - - - -

PAR—Crucible Steel Casting Co., Cleveland.

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No. 2; C 0.25, Si 0.45, Mn 0.65, Ni 2.75, Cr 1.75, Mo 0.3, P 0.05; sand castings. In heat-treated state; Ts, 100,000 psi; ys, 75,000 psi; elong, 20 per cent; impact resistance, low; bhn, 230; magnetic; abrasion resistance, high; can be heat-treated for good wear resistance.

1 2 - - - - - -

No. 6; C 0.2 max, Si 0.85, Mn 0.7, Cr 25, Ni 12; sand castings. In heat-treated state: Ts, 80,000 psi; ys, 42,000 psi; elong, 32 per cent; impact resistance, high; bhn, 165; sp gr 7.5; nonmagnetic. Resists corrosion caused by sulphur dioxide; heat-resistant to 2000 F; abrasion resistance, low. Used for furnace parts and machine parts where corrosion resistance is desired.

No. 7; C 0.3, Si 0.85, Mn 0.7, Ni 35, Cr 15; sand castings. In untreated state: Ts, 73,000 psi; ys, 41,000 psi; elong, 7 per cent; impact resistance, low; bhn, 170; sp gr, 7.8; nonmagnetic; corrosion resistant; good for hydrochloric acid solution; heat-resistant to 2000 F; abrasion resistance, low. For heat-treating furnace parts, carburizing boxes, etc.

- 2 - 4 5 - - -

PAR-EXC—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.50, Si 0.28, Mn 0.20, W 2.00, Cr 1.65 and V 0.25; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Hardness, rockwell C, 58 max; magnetic; weldability, fair; max cont. serv. temp, 600-800 F; abrasion resistance, medium. For wearing parts requiring a hard surface and a very high-strength core.

- - 3 4 - - - -

PENN—Titan Metal Mfg. Co., Bellefonte, Pa. General purpose bronze welding rod where high-strength ductile welds are desired. Resists abrasion.

- - 3 4 - - - -

PERDURO—The Jeffrey Mfg. Co., Columbus, O. C 0.60-1.90, combined C 0.40-0.60, Mn 0.50-0.70, Si 0.90-1.10, Cu 0.90-1.10. Malleable iron castings; heat treated; ts, 80-90,000 psi; ys, 60-70,000 psi; elong in 2 in., 8-6 per cent; bhn, 179-207. For chain links, sprockets, etc.

1 2 - 4 5 - - -

PERMITE—Aluminum Industries Inc., Cincinnati. Following grades are available as sand castings, and permanent-mold castings:

1 2 - 4 - - - -

No. 1002; Cu 10, Fe 1.5, Mg 0.4, balance Al. For pistons for automotive, pump and refrigeration service.

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No. 1010; Cu 4, Si 1, balance Al. For machine parts to resist shock. Heat treatment is to soak at critical and quench in water, and reheat at 350 F to desired properties.

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No. 1019; furnished in ingots and sand castings and permanent-mold castings. Si 5, Cu 1.25, Mg 0.5, balance Al; heat treatment, quenching in water. Suitable for highly-stressed parts including airplane engine parts.

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No. 2011; Si 5, balance Al. For parts subject to atmospheric corrosion.

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No. 2021; Mg 4, balance Al. For parts subject to salt water corrosion.

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No. 2023; Mg 10, balance Al. For parts subject to high stress; furnished heat treated.

PERMOLD Castings—The Permold Co., Medina, O. Sand cast and permanent-mold aluminum and magnesium castings of standard analyses to specification.

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PETERSON Steel — Peterson Steels Inc., New York 17. An SAE 52100 steel in following analysis: C 0.95-1.10, Mn 0.25-0.45, Si 0.20-0.35, P 0.25 max, S 0.25 max, Cr 1.30-1.60, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in rough bars or billets, finished rods or bars and tubing. In heat-treated state: Ys, 146 tons per sq. in.; hardness, rockwell C, 62-65; abrasion resistance, high. For ball and roller bearings, spindles, thrust collars, hardened sleeves, clutch liners and faces, etc.

PHILO—Ohio Ferro Alloys Corp., Canton, O. Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

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PHOS-COPPER — Westinghouse Electric Corp., East Pittsburgh, Pa., brazing alloy manufactured in rod and strip form, containing 5-7 per cent phosphorus and balance copper; highly corrosion-resistant; gives strong joints when used for brazing copper and copper alloys to each other.

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PHOSNIC Bronze—Chase Brass & Copper Co. Inc., Waterbury 91, Conn. Cu 98.15, Ni 1.10, P 0.25. Furnished in wire. Heat treated: Ts, 120,000 psi; ys, 105,000 psi; elong in 2 in., 3 per cent; hardness, rockwell B, 95; nonmagnetic; resists industrial atmospheres, sea air and water, many saline solutions and dilute acids. For bolts, screws, rivets, springs, etc.

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PITALOY — Pittsburgh Steel Foundry Corp., Glassport, Pa. Manganese-molybdenum alloy: Ts, 85,000 psi; ys, 55,000 psi; elong, 22 per cent; reduction of area, 40 per cent; machinability, good. Used for locomotive frames, crossheads, coupling boxes and spindles, driving wheel centers, gears, etc.

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PITTSBURGH Alloy and Stainless Steels—Pittsburgh Steel Co., Pittsburgh.

Alloy steels as follows:

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Open-hearth aircraft or commercial quality alloy steels in bars, billets, rod and wire.

AMS6320A (NE 8735); good machining properties in annealed state and capable of being heat-treated to required physicals in the finished size.

A4337; high alloy open-hearth steels; can be heat-treated to high yield strength and high ductility.

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Standard stainless steels of various chromium-nickel-carbon types, such as Types, 301, 302, 303, 304, 308, 310, 316, 317, 319, 321, 347, 410, 414, 416, 420, 430, 501 and 502. For property and application data see "Stainless Steels" listing elsewhere in this section.

PITTSBURGH Steels—Pittsburgh Steel Co., Pittsburgh 30. Carbon and alloy steels, carbon and alloy wire and rods, and carbon, alloy and stainless seamless tubes to standard specifications such as AISI and SAE Analyses.

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PLAST-IRON—Plastic Metals Div., The National Radiator Co., Johnstown, Pa. Powder metal of 99.9 per cent iron. After pressing in die, material is sintered in protective atmosphere at 1800 to 2200 F for from 30 to 90 minutes. Apparent density of powder, 2.2-2.7 grams per cu cm; weldability, good; abrasion resistance, high. For oilless bearings, permanent magnets, iron cores, and other powder metal parts.

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PLAST-MANGANESE—Plastic Metals Div., The National Radiator Co., Johnstown, Pa. Powder metal of 99 per cent manganese. Apparent density 3.5 grams per cu cm; nonmagnetic. For strong, hard ferrous parts made by powder metallurgy.

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PLAST-SILICON—Plastic Metals Div., The National Radiator Co., Johnstown, Pa. Si 97, Fe 1. Powder metal for alloying. Apparent density, 0.9 to 1.3 grams per cu cm; nonmagnetic. For parts made by powder metallurgy requiring special corrosion resistance or electrical properties.

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PLAST-SPONGE—Plastic Metals Div., The National Radiator Co., Johnstown, Pa. Fe 97, O 0.9, Mn 0.3, P 0.1, Si 0.2. Powder metal. After pressing in die, sinter in protective atmosphere at 1800-2200 F; for from 30 to 90 minutes. Apparent density of powder 2.2-2.7 grams per cu cm; magnetic; weldability, fair; abrasion resistance, high. For oilless bearings, permanent magnet iron cores, and other parts made by powder metallurgy.

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PLATINUM CLAD—Baker & Co. Inc., Newark 5, N. J. Pure platinum welded to various base metals, in sheet, tubing and wire. Resists corrosion caused by usual acids; medium abrasion resistance; good weldability; tensile strength, ductility, etc., are dependent upon properties of base metals. Used for tubing exposed to acids and for vessels subject to same.

1 2 3 - - - - -

PLURAMELT — Allegheny-Ludlum Steel Corp., Brackenridge, Pa. Combination of mild steel and stainless steel; in sheets, strips, and plates; for general fabrication; corrosion resistant. Combines qualities of the stainless steel and plain steel of which it is composed.

See advertisement, Page 313

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing qualities
7—Electrical properties
8—Machinability

1 - 3 4 - - - -

POMPTON — Allegheny Ludlum Steel Corp., Brackenridge, Pa. C .95-1.05. For arbors, bushings, collets and lathe centers. Water hardening.

See advertisement, Page 313

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POWDIRON — Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Porous iron bearing alloys available in three grades. All have high compressive strength.

55P; contains no tin and only 5 per cent copper. Used to conserve copper and tin. Ts, 12,000 psi; sp gr, 5.5; comp str, 140,000. Subject to corrosion under certain conditions, but due to protective film of oil will show less tendency to corrode than steel shaft.

61-IC; contains no tin and only 10 per cent copper and is impregnated with 25 per cent of oil by volume. Stronger than other materials furnished by company, and recommended for heavy-duty, slower motion requirements where tensile strength is determining factor, as in aviation and ordnance industries. Ts, 30,000 psi; comp str, 140,000.

59-I; straight-iron material impregnated with 25 per cent oil by volume. Recommended for parts other than bearings which may or may not be sized to close dimensions. Smooth mirror finished surface reduces friction. Ts, 12,000 psi; comp str, 130,000.

See advertisement, Page 284

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PRECISION—Precision Castings Co. Inc., Syracuse, N. Y.

Type A-12; aluminum base alloy; Si 12, balance Al. Resists heat to 1000 F; ts, 33,000 psi; sp gr 2.66. For general aluminum die casting uses.

Type ZN-5, zinc base alloy; Al 4, Cu 1, Mg 0.04, balance zinc; ts. 42,000 psi; comp str, 85,000; sp gr, 6.71; bhn, 75. For general die casting uses—automotive, washing machines, electrical equipment, etc.

A-50; aluminum base alloy; Si 5, Al bal., furnished as castings. Resists corrosion caused by atmosphere, foods, etc., resists heat to 1000 F; abrasion resistance, medium; ts. 29,000 psi; ductility, medium. For use where corrosion resistance and ductility are needed.

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A 54; aluminum base alloy; Si 5, Cu 4, Al bal., furnished as castings. Resists corosion caused by atmosphere; resists heat to 1000 F; ts, 32 000 psi. General aluminum die cast parts.

A-94; aluminum base alloy. Si 8.5, Cu 3.5, Al bal. Substitute for A-54 alloy wherever possible. Conforms to Federal Specification AXS-679, Rev. 3.

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PRECISION Tubing and Wire—Precision Tube Co., Philadelphia.

Seamless tubing in nickel, aluminum, copper and brass. For machining, cold working, drawing, brazing and plating. Hardnesses to specification. For vacuum tube parts, air restriction tubing, temperature and pressure control apparatus and instrument pointers.

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Precision metal shielded wire; copper, brass, aluminum or nickel, tubing around virtually any dielectric and inner conductor. For machining and cold working; weldability, good; max cont. serv. temp. depends on dielectric strength. For electronic equipment, sound systems, shielding conductors in corrosive atmospheres, shielded wires, radio components.

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PREMIER—American Steel & Wire Co., Cleveland. Specially processed steel wire having high yield and fatigue strength.

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PRESSUREDIE No. 2 — Braeburn Alloy Steel Corp., Braeburn, Pa. C 0.35, Si 0.90, Cr 5.00, V 0.20, Mo 1.40 and W 1.10; furnished in rough bars or billets, finished rods or bars, for machining. Recommended heat treatment, 1825 F air cool, draw 1050-1150 F. In heat-treated state: Ts, 250,000 psi; ys, 200,000 psi; bhn, 417-514. For extrusion dies, extrusion press rams and liners, etc.

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PROMAL—Link-Belt Co., Indianapolis 6. Specially processed malleable iron having high yield and fatigue strengths; for resistance to mild corrosive attack can be furnished with copper content; can be hot dip galvanized without embrittlement and can be used in ovens and furnaces up to 1100 F. Uses include conveyor and drive chain links, bearing caps, rocker arms, sheaves, levers and other parts subjected to severe service.

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PROMET—The American Crucible Products Co., Lorain, O. Heat-treated bronze bearing metals having great compressive strength, low coefficient of friction, lubricating qualities. Ts, 18-50,000 psi; ys, 11-26,000 psi; bhn, 38-75; elong in 2 in., 26.5-12 per cent. For bearings and wearing parts, such as spur and worm gears. Also heavy machinery seals.

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PSF—Pittsburgh Steel Foundry Corp., Glassport, Pa. Steel castings up to the largest in carbon or alloy steels and Pitaloy. For railroad and marine industries; also for other types of machines.

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PSI—Peterson Steels Inc., New York 17.

No. 1; C 0.92-1.02, Mn 0.95-1.25, Si 0.50-0.70, P 0.025 max, Cr 0.90-1.15, S 0.025 max. Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in rough bars or billets, finished rods or bars and tubing, for machining. Abrasion resistance and tensile strength, high. For ball and roller bearings, bushings, thrust collars, spindles, hardened sleeves, clutch liners and faces, knives, etc.

No. 2; C 0.87-0.97, Mn 1.40-1.70, Si 0.60-0.80, P 0.025 max, S 0.025 max, Cr 1.40-1.70, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max; furnished in ingots. Ts, 17,850 psi; ys, 8875 rods or bars and tubing, for machining. Abrasion resistance and tensile strength, high; good bearing qualities. For ball and roller bearings, bushings, spindles, collars, hardened sleeves, clutch liners and faces, etc.

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PYRAMID METAL—Magnolia Metal Co., Elizabeth, N. J. Lead-tin-antimony-arsenic alloy furnished in ingots. Ts, 17,850 psi; ys, 8875 psi; bhn, 25; abrasion resistance, medium. For applications where bearings must withstand heavy sustained pressures such as in marine reciprocating engines, water turbines, paper mill calendar stocks, etc.

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PYRASTEEL—Chicago Steel Foundry Co., Chicago. Ni varies from 8 per cent up. Cr from 08.26 per cent; available as castings for heat-treating furnaces, screw conveyors, or any high-temperature service to 2200 F. Also available in following grades:

No. 20; Ni 35, Cr 18.
No. 18; Ni 25, Cr 16.
No. 2000; Cr 26-28, Ni 12-14
No. 14; Cr 6, Mo 5.

All of these grades carry a high silicon content, varying from 1-2.5 per cent.

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PYTHON—Allegheny Ludlum Steel Corp., Brackenridge, Pa. C 0.85, V 0.25. For chuck jaws, clutch pins and other parts requiring unusual wear and shock resistance. Water hardening.

See advertisement, Page 313

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RANDALL—Randall Graphite Products Corp., Chicago. S.A.E. No. 64 bronze or as specified; furnished as sand castings. Resists corrosion caused by moisture; resists heat to 700 F; high abrasion resistance; ts, 30,000 psi; medium ductility; good bearing properties; conductivity, good; bhn, untreated 80. For use as bushings, graphite-inserted in the perforated or drilled hole, grooved, or reservoir types.

RANIER—Ohio Ferro Alloys Corp., Canton, O. Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

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READY FLOW Silver Brazing Alloys—The American Platinum Works, Newark, N. J. Various silver brazing alloys having melting points ranging from 1165 to 1530 F in form of wire, strip, sheet and filings. Also sterling silver in form of sheet, bars, strip, blanks, wire, etc. Also platinum and platinum alloys.

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REDALOY No. 1 Forging Brass—Titan Metal Mfg. Co., Bellefonte, Pa. Cu 54, Pb 3.4, balance Zn. Forges freely but is slightly more difficult to machine than yellow brass. Color matches closely that of red brass. Used in hardware and plumbing industries.

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RED ANCHOR—Anchor Drawn Steel Co., Latrobe, Pa. C 0.95-1.1; commercial carbon drill rods. Strength varies from 70,000 psi, annealed; to 225,000 psi fully hardened; reduction in area when annealed, as high as 50 per cent. For precision shafts for motors, spindles, anvils, etc.

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RED-CUT SUPERIOR—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.50, 0.60 and 0.70, Cr 4.00, V 1.00, Si 0.25, and Mn 0.25; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods; for machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: Impact str, Charpy (unnotched), 30; hardness, rockwell C 67 max; sp gr, 8.67; magnetic; max. cont. serv. temp, 1200 F; abrasion resistance, high. For high temperature springs, etc.

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REDX ALUMINUM ALLOYS—National Smelting Co., Cleveland 5.

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X-5; Si 5.5, Cu 1.5, Mg 0.3; furnished in rough bars or billets for sand casting, die casting, and forging. As sand cast: Ts, 32,000 psi; ys, 20,000 psi; elong, 1.5 per cent min; impact resistance, medium; endurance limit, 10,000 psi at 100 millions; bhn, 80; sp gr, 2.69; nonmagnetic; heat-resistant to 300 F. For engine and motor castings, such as crankcase, cylinder block, heads, etc.

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X-8; Si 8, Mn 0.3, Mg 0.3, Cu 1.5, remainder Al; furnished in rough bars or billets; for sand casting, die casting and forging. As sand cast: Ts, 33,000 psi; ys, 25,000 psi; elong, 1 per cent; impact resistance, medium; bhn, 70-90; sp gr, 2.69; nonmagnetic; weldability, good; heat-resistant to 350 F; abrasion resistance, medium. For internal combustion engine parts, cylinder heads, motor-blocks, crankcases, housings, etc.

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X-10; Si 10, Mg 0.5, Mn 0.5, Cu 1.5; furnished in rough bars or billets; for sand casting and die casting. Mechanical properties (permanent mold cast): Ts, 36,000 psi; ys, 33,000 psi; impact resistance, medium; bhn, 95-105; sp gr, 2.69; nonmagnetic; weldability, good; heat-resistant to 400 F. For diesel and automotive pistons and similar bearing parts.

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X-13; Cu 1.5, Si 0.2, Mg 0.5, and Mn 0.5; furnished in rough bars or billets and as permanent mold castings. Ts, 36 000 psi; ys, 32 000 psi; impact resistance, low; bhn, 90 min; sp gr, 2.68; nonmagnetic; weldability, fair; resists heat to 350 F; abrasion resistance, high; has low expansion. For diesel and automotive pistons. The company produces most of the common aluminm alloys in ingot forms for casting, shotted, granulated and powdered aluminum and aluminum alloys, and magnesium and magnesium alloys, some of which are given above.

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REPUBLIC Double Strength Steel — Republic Steel Corp., Cleveland 1. Low-carbon, Ni-Cu-Mo steel furnished in finished rods or bars, straight and coiled strip, tubing, sheet and plate; for machining, hot and cold working, stamping, drawing, and arc welding. In cold-worked state, ts, 70,000 psi, min; ys, 50 000 psi, min; elong in 2 in., 22 per cent, min; magnetic; resists corrosion caused by atmosphere; abrasion resistance, medium.

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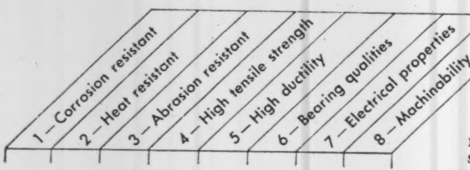
RESISTAC—American Manganese Bronze Co., Philadelphia 36, Pa. Three grades of aluminum bronze; available in sand castings,



rods or bars and hammered forgings; strong; light. Resist certain acids and chemicals; retain strength at high temperatures; have excellent fatigue values. Compositions and physical characteristics for all grades are given below:

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Nos. 1 and 2; Cu 85-90, Al 8-11, Fe 4 max; ts, untreated, 65-80,000 psi; ys, 28-35,000 psi; elong in 2 in., 20-30 per cent; impact resistance, medium; bhn, 120-150; nonmagnetic; weldability, fair; resists heat to 500 F; abrasion resistance, medium. Used for parts requiring high corrosion resistance, strength, and heat resistance, such as mill and valve guides: and for parts requiring good fatigue resistance.

1 - - 4 - - - 8
No. 3; Cu 80 min, Al 8-10, Fe 5 max, Ni 5 max. Can be heat-treated by quenching from 1600 F, drawn at 700-1000 F, increasing strength and hardness but lowering ductility. In untreated state: Ts, 90,000 psi min; ys, 42,000 psi; elong in 2 in., 15 per cent; impact resistance, medium; bhn, 185 min; practically nonmagnetic; weldability, fair. Heat resistant to 500 F; abrasion resistance, low. For parts requiring high corrosion resistance and strength, such as gears, guides, etc.

See advertisement, Page 314

1 - - - 5 - - 8
RESISTALOY—Titan Metal Mfg. Co., Bellefonte, Pa. Forgeable bronze; Cu 59, Al 2.00, Ni 1.00, Si 0.50, Fe 0.25, balance Zn. In cold-drawn state: Ts, 109,750 psi; ys, 85.000 psi; elong in 2 in., 14.5 per cent; hardness, rockwell B, 92-94. Exceptionally resistant to corrosion by sea water. For shafts, special bearings. forgings, bolts, nuts, studs, etc., on marine equipment.

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RESISTRESS—Reliance Steel Casting Co., Pittsburgh. Manganese-nickel-vanadium alloy steel furnished as sand castings. Recommended heat treatment; double normalized and drawn. In heat-treated state: Ts, 90,000 psi; ys. 60,000 psi; elong in 2 in., 25 per cent; bhn, 180. For machine parts subject to high stress and impact.

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REVALON—Revere Copper & Brass Inc., New York 17. C 76, Al 2.25, As 0.04, balance Zn; in tubing and plates. In fabrication, material can be brazed. soldered or welded. Resists corrosion caused by high velocity, salt or brackish waters. Abrasion resistance, medium; ts, 83,000 psi; ductility, high; sp gr, 8.31. Used for condenser tubes for utility, oil refinery, marine, heat exchangers, etc.

See advertisements, Pages 263-264

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REVERE—Revere Copper & Brass Inc., New York 17.

Magnesium; various alloys in sheets, strips, plates, rods, bars, forging stock, angles, channels, extruded shapes, seamless tubes and forgings.

Aluminum; various alloys in rods, bars, forging stock, angles, channels, extruded shapes, seamless tubes and forgings.

See advertisements, Pages 263-264

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REVERE Free-Cutting Brass—Revere Copper & Brass Inc., New York 17. Cu 61.5, Zn 35.5, and Pb 3; furnished in finished rods or bars, straight and coiled strip, for machining into parts. In cold-worked state: ts, 65,000 psi; ys, 54,000 psi; elong in 2 in., 15 per cent; hardness, 72 rockwell B; sp gr, 8.40. For rods, deep drilling, turning, free-cutting for screw machine parts.

See advertisements, Pages 263-264

1 - 3 4 - - - -
REX Z METAL—Chain Belt Co., Milwaukee 4. Furnished as castings; resists corrosion caused by weather and inorganic acids to a degree; resists heat to 800 F; high abrasion resistance; ts, 80.000 psi, medium ductility; sp gr, 7.45; good bearing properties; bhn. untreated, 200. For cast parts requiring high strength and good machinability.

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REYNOLDS Wrought Aluminum Alloys — Reynolds Metals Co. Inc., Louisville 1, Ky.

2S; available in flat and coiled sheet, plate, rolled rod and bar, extruded rod, bar and sheets, drawn tubing and pipe.

3S; available in flat and coiled sheet, plate, rolled rod and bar, extruded rod, bar and sheets, drawn tubing and pipe.

14S; available in extruded rod, bar and shapes, rolled structural shapes and forging stock.

17S; available in drawn wire, rolled rod and bar, screw machine stock.

18S; available in forging stock.

24S; available in flat and coiled sheet, plate, drawn wire, rolled rod and bar, extruded bar, rod and shapes, and drawn round tubing and pipe.

Pure Clad 24S; available in flat and coiled sheet, plate.

25S; available in forging stock.

32S; available in forging stock.

A51S; available in forging stock.

52S; available in flat and coiled sheet, plate, drawn wire, rolled rod and bar, drawn round tubing and pipe.

63S; available in extruded rod, bar and sheets and extruded round tubing and pipe.

Hard Clad R301; available in flat and coiled sheet, plate.

R303; available in extruded rod, bar and shapes and forging stock.

R317; available in drawn wire, rolled rod and bar, screw machine stock.

R353; available in extruded rod, bar and shapes.

R361; available in flat and coiled sheets, plate, drawn wire, rolled rod and bar, extruded rod, bar and shapes, rolled structural shapes, forging stock, drawn tubing and pipe, extruded tubing and pipe.

See advertisements, Pages 282-283

1 2 - - - 6 - 8
REZISTAL Stainless Steels—Crucible Steel Co. of America, New York. Stainless steels in standard forms to AISI Specs. 302, 303, 304, 309, 310, 311, 316, 321, 347, 410, 416, 420, 430, 431, 440A, 442, 446 501 and 502. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

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RIGIDIZED Metal—Rigid-Tex Corp., Buffalo 3. Any ferrous or nonferrous alloy in sheet or strip form for structural machine members such as frames, stressed housings, etc.

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RIVERSIDE—Riverside Metal Co., Riverside, N. J. Phosphor bronze, nickel silver and beryllium copper in sheet, strip, wire and rod form.

See advertisement, Page 301

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ROCKRITE Seamless Tubing — Tube Reducing Corp., Wallington, N. J. In SAE-52100 steel analysis; furnished in seamless tubing (cold-reduced), for machining. In cold-worked state: Ts, 140,000 psi; ys, 135,000 psi avg; elong in 2 in., 10 per cent; hardness, rockwell C, 31 max; abrasion resistance, high. For bearing raceways, sleeves, cylindrical tool parts, or any parts which are to be subjected to wear or abrasion.

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ROL-MAN—Manganese Steel Forge Co., Philadelphia. Furnished in rods or bars, wire, sheets and plates, also hot forgings, stampings, wire cloth, welded and ground parts. Contains Mn 11-14; C 1.1-1.4. Resists heat to 400 F; has high abrasion resistance; ts, 140-160,000 psi; comp str, 100,000 psi; high ductility; nonmagnetic; bhn, heat-treated, 190-210; work-hardened, 325-500. Used where abrasion resistance and high strength are needed.

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ROMAN BRONZE—Revere Copper & Brass Inc., New York 17. Cu 60, Zn 39.25, Sn 0.75; furnished in finished rods or bars and plate, for machining, hot and cold working, and arc, gas and resistance welding. In cold-worked state: ts, 82,000 psi; ys, 55,000 psi; elong in 2 in., 20 per cent; endurance limit (completely reversed bending), 27,000 psi; sp gr 8.34; max cont. serv. temp, 400 F; abrasion resistance, high; resists corrosion caused by salt water. For propeller and pump shafts, piston rods, marine uses, tube sheets, etc.

See advertisements, Pages 263-264

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ROSS-MEEHAN—Ross Meehan Foundries, Chattanooga, Tenn.

- - 3 4 - - - 8
Medium-manganese cast steel; C 0.40-0.50, Mn 1.40-1.60, furnished as sand castings. Heat treated to requirements. In untreated state: ts, 90,000 psi; ys, 55,000 psi; elong in 2 in., 22 per cent; impact str, 15 ft-lb (Charpy); bhn, 220; max cont. serv. temp, 750 F; abrasion resistance, high. For sprockets, clutches, rollers, worms or other parts requiring wear resistance and strength where shock loading is not too high.

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Manganese-molybdenum cast steel; C 0.30-0.40, Mn 1.40-1.60, and Mo 0.30-0.40; furnished as sand castings; heat treated to requirements. In untreated state: ts, 90-100,000 psi; ys, 55-65,000 psi; elong. in 2 in., 22 per cent; impact str, 25 ft-lb (Charpy); bhn, 220; weldability, good: max cont. serv. temp, 750 F; abrasion resistance, medium. For machine parts such as frames, yokes, couplings, fittings, etc., where strength and impact resistance are required.

Manganese-vanadium cast steel; C 0.22-0.27, Mn 1.60-1.80, and V 0.10-0.15, furnished as sand castings, heat treated to requirements. In untreated state: ts, 90.000 psi; ys, 55,000 psi; elong in 2 in., 25 per cent; impact str, 50 ft-lb (Charpy); bhn, 207; weldability, fair; abrasion resistance, low. For parts requiring good strength and good resistance to impact loading.

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ROTARY Steels—Rotary Electric Steel Co., Detroit 20. All standard SAE grades of alloy steels in standard forms.

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RUSTLESS Stainless Steels—Rustless Iron and Steel Div., The American Rolling Mill Co., Baltimore 13. Standard stainless steels of AISI Types 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 410, 414. 416, 420, 420F, 431, 440A, 440B, 440C, 440F. 430. 430F, 442. 446, 501, and 502. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

See advertisemnt, Page 305

1 - - 4 - - - 8
RYERSON Steels—Joseph T. Ryerson & Son Inc., Chicago 80. All standard wrought, carbon, alloy and stainless steels in standard forms. Complete hardenability data furnished with all stock. (For property and application data on "Stainless Steels" see listing elsewhere in this section.)

See advertisement, Page 310

S

1 2 - - - 6 - -
SABECO—Saginaw Bearing Co., Saginaw, Mich.

No. 5 bearing bronze; Cu 69-71, Sn 4.5-5.5, Pb 24-26 max, impurities 0.2. For light or medium-load and water-lubricated bearings.

No. 9; Cu 69-71, Sn 8.5-9.5, Pb 20-22 max, impurities 0.2. For heavy loads such as average machine tool requirements.

No. 11; Cu 69-71, Sn 10.5-11.5, Pb 18-20 max, impurities 0.2. For worm wheels, clutch shifter shoes, forging machine slides, and extreme heavy bearing conditions.

No. 16; Cu 69-71, Sn 15-16.5, Pb 13.5-14.5 max, impurities 0.2. For friction rings, and heavy-duty boring spindle bearings.

See advertisement, Page 132

1 - 3 4 - 6 - -
SANDUSKY—Sandusky Foundry & Machine Co., Sandusky, O. Centrifugally cast bronze, brass and Monel sleeves, liners, tubes, bushings and roll covers from 3 to 46 in. diam. in lengths up to 347 in. depending upon diameters and metal composition. Rings are available from 3 to 72 in. diam. Improved physical properties and machinability resulting from the Sandusky process.

Also bearing metals, copper-base metals and nickel base metals.

See advertisement, Page 306

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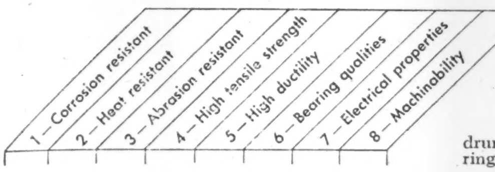
SATCO Bearing Metal — Magnus Metal Corp., Chicago. Lead-base alloy containing from 94-98 per cent lead, with balance tin, calcium and other auxiliary hardeners; melting point about 125 degrees higher than that of tin-base and lead-base babbitt metals, with higher resistance to deformation and wiping at elevated temperature. Material is furnished in ingot form and also lined bearings. Mechanical properties in untreated state; ts,



11-13,000 psi; comp str, 15-17,000; elongation, 8-12 per cent; bhn, 22-24. Recommended as a lining for brass, bronze and steel back bearings. May be used as a substitute for lead and tin base babbitts, block tin and other bearing metals.

1 - - - - 6 7 8
SCOVILL—Scovill Mfg. Co., Waterbury, Conn. A complete line of standard high and low brasses, phosphor-bronzes, nickel-silvers, and cupro-nickels, furnished in form of sheet, rod, wire and tubing, for various mechanical, electrical and heat-exchanger purposes.

See advertisement, Page 295

1 - - - - - - -
SEALMET — Allegheny Ludlum Steel Corp., Brackenridge, Pa. Typical analysis—Cr 27, balance Fe. Alloys having same coefficient of expansion as certain grades of glass. For application where metal wires or strip must be attached directly to glass.

See advertisement, Page 313

- - - - - 6 7 -
SELFLUBE—Keystone Carbon Co., Saint Marys, Pa. Self-lubricating porous bronze and porous iron, bearings and sleeves; yield point for bronze, 12,090 psi; 30,000 psi min, 50,000 psi max, for iron; ductility, high. For bearings, bushings, etc. Also bronze, brass and iron for structural parts.

- - 3 4 - - - 8
SEMINOLE — Allegheny Ludlum Steel Corp., Brackenridge, Pa. C 0.45, Cr 1.3, W 2, V 0.25. For high creep strength bolts and studs for super-heated steam; also machine parts having high wear and fatigue values. Withstands moderately elevated temperatures. May be oil hardened.

See advertisement, Page 313

- - - - 5 - 7 8
S.G.—Symington-Gould Corp., Rochester, N. Y. Cast carbon steels in following grades:

27; C 0.10, Mn 0.10; normalized, ts, 50,000 psi; ys, 25 000 psi; elong in 2 in., 30 per cent. For electrical applications.

26; C 0.20, Mn 0.50; normalized ts, 60,000 psi; ys, 30,000 psi; elong in 2 in., 26 per cent. For valves, etc.

25; C 0.26, Mn 0.70; normalized, ts, 70,000 psi; ys, 38.000 psi; elong in 2 in., 24 per cent. For railroad and industrial applications.

18; C 0.45, Mn 0.70; normalized, ts, 85,000 psi; ys, 45,000 psi; elong in 2 in., 16 per cent; bhn, 170. For automotive parts.

9; C 0.26, Mn 0.75; normalized and drawn, ts, 70,000 psi; ys 36,000 psi; elong in 2 in., 22 per cent. For parts subject to steam pressure.

28; C 0.30, Mn 0.90; normalized and drawn, ts, 80,000 psi; ys, 40,000 psi; elong in 2 in., 18 per cent; bhn, 160. For parts subject to steam pressure.

1 2 - - - - - -
SHARON STEELS—Sharon Steel Corp., Sharon, Pa. All standard carbon, alloy and stainless steels in standard forms. Furnished in straight and coiled strip, and sheets, for machining, hot and cold working, stamping, drawing, brazing, and arc, gas and resistance welding. (For property and application data on stainless, see "Stainless Steel" listing elsewhere in this section.)

- - - 4 - - - -
SHENANGO-PENN—Shenango-Penn Mold Co., Dover, O. Centrifugal castings in all bronzes. Monel Metal and alloy irons—a complete range of red bronze alloys, as well as yellow metals including manganese bronzes and aluminum bronzes. Also special alloys such as aluminum and silicon bronzes, copper, etc. Grades of plain and alloy iron, as well as Ni-Resist are available. Furnished in cast tubular bars or cylinders in sizes from 2-26 in. OD and to 26 ft in length; solid bars in diameters ranging from ½ to 8 in.—in standard 6-ft lengths. For immediate delivery stock of both solid and tubular bars under 6¾ in. OD is maintained. Can be adapted to any application where castings are used. Flanges and unusual shapes of various sizes also available. For bearings, bushings, drums, liners, roll covers, sleeves, washers, rings etc.

- - - 4 - - - -
SHIELD-ARC—Lincoln Electric Co., Cleveland. Type 85; high-tensile welding rod; recommended for fabrications of high-tensile steels; bhn, 190-250.

Type 100; bhn 235-300.

1 - - 4 5 - - -
SHOCKPROOF—Lake City Malleable Co., Cleveland. Malleable castings of high tensile strength, high yield point and ability to withstand shock and abuse, possessing good machining qualities and resistance to corrosion. Ts, 53-60,000 psi; ys, 35-40,000 psi.

See advertisement, Page 320

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SHOOK Alloy 664—Shook Bronze Corp., Lima, O. Cu 80-83, Sn 7-9, Pb 7-9, Zn 1-2, P 0.75 and Ni 1 max; furnished in finished rods or bars and as sand castings; for machining. Comp str, 35 000 psi; ys, 22.000 psi; elong in 2 in., 20 per cent. For bushings, bearings, gland nuts, gears, etc.

1 2 - - - - - -
SICROMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

Type 1; C 0.15 max, Mn 0.5 max, P .03 max, S .03 max, Si 1-1.4, Cr 0.75-1.25, Mo 0.45-0.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Material is corrosion resistant to 1050 F; ts, 60,000 psi min; fair weldability; bhn, annealed, 163 max. For use in oil refinery field.

Type 2; similar to above with slightly higher chromium content.

Type 2½; similar to Type 2 with slightly lower silicon content.

Type 3; similar to Type 2½, with slightly higher silicone and chromium content.

Type 5; similar to Type 3, with lower silicon content and higher chromium.

Type 5S; similar to Type 5, differing only in higher silicon content.

Type 7; similar to Type 5S, having lower silicon and higher chromium content.

Type 9; similar to Type 7, having higher chromium content. All above materials are for oil refinery use.

Type 7M; similar to Type 7, but having an increased molybdenum content.

Type 9M; similar to Type 9, but having an increased molybdenum content.

See advertisement, Page 273

1 - - 4 5 - - -
SIL-FOS—Handy & Harman, New York 7, Brazing alloy containing Ag 15, Cu 80, P 5; flows at 1300 F; furnished in rods, wire, sheets and strips (coiled). Corrosion-resistant; high ductility; sp gr, 8.45. Used to join nonferrous metals only, particularly copper, brass and bronze.

1 - 3 - - - - -
SILFRAM—Stoody Co., Whittier, Calif. A cast hard-facing rod of Cr, Ni, Si, C and Fe Good bearing surface; excellent resistance to corrosion; can be machined with carbide tools; rockwell C hardness, 38. For hard-facing equipment subject to corrosion, abrasion and impact, such as pump sleeves, valves, etc.

- - - 4 5 - - -
SILMAN—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. C 0.55, Si 2.10, Mn 0.85, Cr 0.25, V 0.28. Furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for permanent-mold casting, precision casting, machining, hot and cold working, stamping, drawing and brazing. In heat-treated state: hardness, rockwell C, 62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels, dogs, shears, etc.

- - - - - - - 8
SILMANAL—General Electric Co., Schenectady, N. Y. Has high intrinsic coercive force, suitable for use in instruments where service in strong electrical fields is required. Ductile and malleable; can be punched, machined, rolled, or ground. Can be made in rod, strip or wire form.

1 2 - - - - - -
SILMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. C 0.15 max, Mn 0.5 max, P 0.4 max, S 0.045 max, Si 1.15-1.65, and Mo 0.45-0.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Ts, 55.000 psi, min; resists heat to 1000 F; fair weldability; bhn, annealed, 163 max. For use in refinery field.

See advertisement, Page 273

- - 3 4 - 6 - 8
SINTEEL—American Electro Metal Corp., Yonkers, N. Y.

- - - 4 - 6 - 8
R; Low-carbon steel powder metal parts to design specifications. Can be surface hardened by gas carburizing or cyaniding. Ts, 61.000 psi; ys, 50.000 psi; elong in 2 in., 5 per cent; hardness, rockwell B 60; abrasion resistance, medium. For cams, gears, and high strength powder metal parts requiring surface hardness up to rockwell C 55.

- - 3 4 - - - 8
G; Copper-steel powder metal parts to design specifications. Ts, 50-100.000 psi; ys, 40-80 000 psi; elong in 2 in., 20-5 per cent; hardness, rockwell B 50-100; nonmagnetic; weldability, poor; abrasion resistance, medium. For high-strength precision powder metal parts.

- 2 - 4 - - - -
SMAVROC—The Medart Co., St. Louis. Alloy steel forgings for rolls for steel or nonferrous mill bar straighteners.

- - - - 5 - - 8
SPEED CASE—Monarch Steel Co., Indianapolis, and affiliate, W. J. Holliday & Co., Hammond, Ind. A low-carbon, free-machining open hearth steel (X1515) furnished in hot-rolled plate and bars, and cold finished bars. Typical analysis: C 0.20, Mn 1.25, S 0.25, P 0.04 max, Si 0.07 max. Ts, 62-72,000 psi. Impact resistance at low temperatures and ductility equal to or better than SAE 1020. Machines readily, 200-250 SFPM (average). Case hardens rapidly with deep, uniform penetration. Has low hysteresis loss. Can be forged, cold-formed or rolled and welded. Widely used for machine tables, gears, spindles, shafts, etc.

- - - - 5 - - 8
SPEED-TREAT—Monarch Steel Co., Indianapolis and affiliated company, W. J. Holliday & Co., Hammond, Ind. A medium-carbon, free-machining open-hearth steel (X1545) furnished in hot-rolled plate and bars, and cold-finished bars. Typical analysis: C 0.45, Mn 1.30; P 0.04, max, S 0.25, Si 0.07 max. Ts, 90-100,000 psi. Machines 50 per cent faster than SAE 1045. Impact resistance at low temperatures and ductility equal to or better than SAE 1045. Can be satisfactorily heat-treated. Medium hardness and hardenability similar to that of SAE 1045. Can be forged and welded. Used for gears, cams, shaft pins, welded shovel dippers, etc.

- - - - - - 7 -
STACKPOLE—Powders—Stackpole Carbon Co., St. Marys, Pa.

Silver-tungsten; for contacts for circuit breakers, relays, contactors, etc; rockwell B, 85-90; sp gr, 11.4-15; weldability, good.

Silver-molybdenum; furnished in parts finished to size; rockwell B, 80, sp gr, 10.3; weldability, good. For contacts for circuit breakers, relays, contactors, etc.

Iron powders; molded to close tolerances. Used for gears, pole pieces for small motors, magnetic yokes, iron cores, also large parts and unusual shapes where much machining is ordinarily involved.

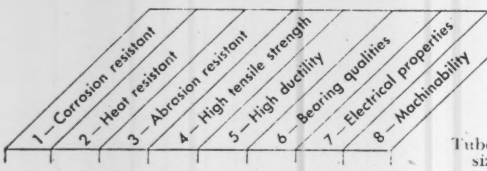
See advertisement, Page 277

1 - - 4 - - - -
STA-GLOSS—Jessop Steel Co., Washington, Pa. Standard stainless steels in Types 420 and 440 For property and application data, see "Stainless Steels" listings elsewhere in this section.

- - - 4 - - - -
STAINWELD—Lincoln Electric Co., Cleveland. Coated. electrode for welding stainless steels or building up surfaces to resist corrosion.

Type A-5; for large number of so-called 18-8 stainless steels. Welds are of high tensile strength and ductility and possess same resistant qualities as the parent metal. Contains suitable amount of columbium to prevent intergranular corrosion of deposited metal.

Type A-7; for stainless steels of 18 per cent chromium, 8 per cent nickel type; fast flow-



ing, smooth operating. Especially adapted for surfacing other steels with minimum admixture of base metal.

Type B; for arc welding stainless steel with chemical content of approximately 25 per cent chromium and 12 per cent nickel. Physical properties equal to metal welded.

Type C; a modification of the well-known 18-8 analysis, commonly known as 18-8 SMO (approx 3½ molybdenum). Suitable for welding stainless steels of Types 316-317.

Type D; for stainless steels of 25 per cent chromium, 20 per cent nickel types; also for welding stainless steels to mild steel and for welding steels which are air-hardened and cannot be heat treated after welding.

1 - - - 5 - - 8
STANDARD Tubing—Standard Tube Co., Detroit 3. Tubing in SAE 1010-1035 carbon steels and 18-8 stainless steel types; for cold working, drawing and resistance welding. In cold-worked state: ts, 48 000 psi: ys. 35 000 psi; elong in 2 in., 25 per cent; hardness, rockwell B, 60-75; weldability, good. Available in a wide variety of shapes and sizes for uses such as roller conveyors, automotive parts, vacuum cleaner handles, washing machine rolls, etc.

See advertisement, Page 293

1 - 3 4 5 - - -
STERLING Stainless Steels—Firth-Sterling Steel Co., McKeesport, Pa. Standard stainless steels furnished in Types 420, 410, 403, 416, 430, 440-C and 302. For property and application data, see "Stainless Steels" listing elsewhere in this section.

- 2 - - 5 - - -
STERMET—Sterling Alloys Inc., Woburn, Boston, Mass. Standard stainless steel castings available in AISI Types 302 303, 309, 310, 312, 316, 321, 327, 330, 347. For property and application data, see "Stainless Steels" listing elsewhere in this section.

- - - - - 6 - 8
STONEWALL Babbitt—United American Metals Corp., Brooklyn 22, N. Y. Furnished in bars and pigs. In cold-worked state: Ts. 10,800 psi; comp str, 16 380 psi; ys, 8720 psi; elong in 2 in., 0 07 per cent: bhn, 24.3. For heavy-duty high-speed service.

1 - 3 - - - - -
STOODEX—Stoody Co., Whittier, Calif. A cast hard-facing rod of Cr, Co, W, C and Fe; can be applied very smooth and thin; requires minimum of grinding; used where smooth, thin deposits are required, also where parts are subject to abrasion and impact such as plow moldboards, clutch fingers, expeller parts, etc.

1 2 3 - - - - -
STOODITE—Stoody Co., Whittier, Calif.

- - 3 - - - - -
Cast hard-facing rod composed of Cr, Mn, Zr, Si, C and Fe; makes excellent bearing surface; resists galling and pitting; rockwell C hardness. 57. Used for hard-facing parts subjected to friction; equally successful for hard-facing parts abraded by earth such as plow shares or other metals such as mill guides.

1 2 3 - - - - -
STOODY—Stoody Co., Whittier, Calif.

Self-hardening, a fabricated hardfacing rod of Cr, Mn, Si, Mo, C and Fe. Forms excellent bond with manganese steel; can be forged; rockwell C hardness, 54. Used chiefly for hard-facing crusher bucket lips and other equipment subject to abrasion and impact.

Stoody 1; cast hard-facing rod composed of Co. Cr. W. Has high resistance to corrosion and abrasion; retains hardness, wear-resistance at red heat; rockwell C hardness, 54. Used for hard-facing wood saw teeth, underreamer lugs, carbon scrapers, wire guides, pump sleeves, etc.

Stoody 6· cast hard-facing rod composed of Co, Cr and W. Has high resistance to abrasion and corrosion: retains hardness and wear resistance at red heat, rockwell C hardness, 44. Used for high-pressure, high-temperature steam valves hot trimming dies, exhaust valves and valve seats.

Tube Borium; a rod made of various screen sizes of irregularly shaped particles of cast tungsten carbide contained in steel tubes. Has high wear resistance; will cut nonmetallic substances; hardness 9-10 on Moh's scale, deposits being heterogeneous. Used on earthworking equipment, drilling and scraping operations, also for hard-facing.

- - - 4 - 6 - 8
STRENES C—The Advance Foundry Co., Dayton 3, O. Alloyed high strength gray iron furnished in sand castings. In untreated state: Ts averages 50,000 psi; bhn, 220; and Charpy impact str, 70 ft-lb. Has fair weldability, medium abrasion resistance. Max cont. serv. temp, 1500 F. Used for cast stamping, forming and drawing dies, jigs, fixtures, die rings, cylinders, and all wearing surfaces as in machine tools.

- - - - - - - 8
STRESSITE—Chrysler Corp., Amplex Div., Detroit 31. Bronze, copper, iron and Super-Oilite powdered metals of high density and physical properties. For use as machine parts of irregular contours, eliminating costly machining operations.

- - - 4 - 6 - 8
STRESSPROOF—La Salle Steel Co., Hammond, Ind. A modified SAE X1340 steel; C 40-48, Mn 1.35-1 65 P 0.04 max, S 0.20-0.32; furnished in finished rods or bars for machining. Ys. 100 000 psi min in sizes up to and including 2 in., and 90 000 psi in sizes over 2 in. through 3¼ in. Requires no heat treating but has replaced carbon and alloy carburizing and heat-treated steels. Used for worm gears, lead screws, spindles, shafts, etc.

- - - - - 6 - -
SUMET — Sumet Corp., Buffalo. High-leaded bronzes as follows:

SM-4; Pb 26-29 per cent. For high-speed and light-duty service.

SM-8; Pb 24-27 per cent. For moderate speed and general service; suitable for machine tool bearings.

SM-10; Pb 22-25 per cent. For general applications such as aeronautical engines, clutch cones and disks, compressors, connecting rods, crank pins, etc.

SM-12; Pb 20-23 per cent. For cone and gyratory crushers, crane and ore machinery, mining machinery, etc.

SM-16; Pb 19-21. For heavy-duty service such as crane motor compressor, dredging machinery, etc.

SM-18; Pb 16.5-18.5 per cent. For crosshead pins, cranes, railroad, steam shovel, etc.

SM-14; Pb 12-15 per cent. For thrust bearings, gears etc.

1 - - 4 - - - -
SUMMERILL—Summerill Tubing Co., Bridgeport, Pa. Seamless tubing in practically all regularly used carbon grades from SAE 1010 to SAE 1095. Others are chrome molybdenum SAE 4130X, 4140, 4150, 4185, 52100, 4340, NE-8630, NE-8635, nickel-silver, pure nickel-silver, corrosion-resistant steels—18-8, 16-13-3 and similar grades; 4 to 6 per cent chrome with ½ moly; also some of 12-14 per cent chrome, beryllium copper, K-Monel and Invar. Available in any shape, and in sizes ranging from 0.012-in. to 5⅛ in. OD. Used for mechanical specialties, aircraft, industrial control instruments, fuel injection tubing for diesel engines, etc.

Also tapered and formed tubes for many special parts.

- - - - 5 6 7 -
SUPERIOR Copper Steel—Superior Metal Co., Chicago 38. Corrosion-resistant strip copper-plated and finished with natural copper, or polished or satin finished on one side. Furnished in coiled or straight strip for stamping. In cold-worked state: resists heat to 1400 F; resists corrosion caused by moisture; magnetic; max cont. serv. temp, 250 F. For parts requiring lubricating qualities of copper plate for involved drawing; or parts to be eventually nickeled or chrome-plated; or applications requiring strength of steel and appearance of polished or satin-finished copper.

1 - - - - - - -
SUPERIOR Magnesium—Superior Bearing Bronze Co., Inc., Magnesium Div., Brooklyn 22. Magnesium castings for specific requirements.

- - 3 4 - - - -
SUPERIOR No. 3—Braeburn Alloy Steel Corp., Braeburn, Pa. C 1.50, Cr 12.00, V 0.85, Mo 0.80; furnished in rough bars or billets and finished rods or bars, for machining. In heat treated state: Comp str, 550,000 psi; hardness, rockwell C, 56-62. For forming rolls, lathe and grinder centers, etc.

1 - - - - - - -
SUPERIOR Prefinished Strip Steel — Superior Metal Works, Chicago 38. Strip steel, prefinished, offered in the following types: Zincsteel, Chromsteel, Nickel Steel, Brass Steel, Copper Steel. Zincsteel used in electronic and aircraft industry, while the others are used in washing machines, automobiles, etc.

- - - 4 5 - - -
SUPERIOR Seamless Tubing—Penn Brass & Copper Co., Erie, Pa. Seamless brass and copper tubing from 5/32-in. OD x 0.010-in. wall, to and including 1-in. OD x 0.072-in. wall; both in copper of pure electrolytic mixture and in brass of 3 alloys, namely; 70/30, 2-1 leaded, and 85/15.

1 2 3 4 5 - - -
SUPERIOR Stainless Steels—Superior Steel Corp., Carnegie, Pa. Hot and cold-rolled strip steel and stainless steels in all standard grades and analyses. For property and application data on stainless, see "Stainless Steel" listing elsewhere in this section.

See advertisement, Page 165

- - 3 4 - - - -
SUPERMAL—The Jeffrey Mfg. Co., Columbus, O. C 1.60-1.80, Mn 0.20-0.40, Si 0.90-1.10; furnished as castings. Heat-treated: Ts, 60-70 000 psi; ys, 50-60,000 psi; elong in 2 in., 8 to 6 per cent; bhn, 179-201. For chain links, buckets, conveyor equipment, etc.

1 - - - - - - -
SUPERSTRIP—Acme Steel Co., Chicago. Hot and cold-rolled strip steel; furnished in sheets and strips (coiled) for stamping into parts. Material is furnished to specification and is available in most sizes from ¼ to 22 in. in width and in thicknesses ¼-inch and less.

- 2 - 4 - - - -
SUPERTEMP—Bethlehem Steel Co., Bethlehem, Pa. A patented alloy steel having high strength at high temperatures. Suitable for bolts and studs for reaction chambers, cracking stills, superheaters, etc.

See advertisement, Page 274

1 2 - - 5 - - -
SUVENEER—Superior Steel Corp., Carnegie, Pa. Steel clad on one or both sides with stainless, copper, and some copper base alloys, etc; furnished in strips; for stamping, welding, deep drawing, rolling, spinning, soldering, etc. Mechanical properties in annealed state: Ts, 50,000 psi; ys, 35 000 psi; elongation, 30 per cent; bhn, 50-60; magnetic. For bearing applications and electrical uses.

See advertisement, Page 165

T

TALIDE—Metal Carbides Corp., Youngstown, O. Tungsten carbide metal; resists corrosion; heat-resistant to 2000 F; abrasion resistance, high; ts, 300,000 psi; sp gr, 14.1; bhn, untreated, 130 and over. For use as wear plates and guides, cutting tools, drawing dies and bushings.

1 - - 4 5 - - -
TAMCO — Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Alloys including original high and medium carbon ferro carbon-titanium, foundry ferro-titanium, and several varieties of low-carbon ferro-titanium for rolled, cast and forged steels, stainless and alloy steels, and gray cast iron.

- - - 4 - - - 8
TELNIC BRONZE—Chase Brass & Copper Co., Waterbury 91, Conn. Cu 98.3, Ni 1.0, P 0.02, Te 0.5. A hard high-strength forgeable, age-hardenable, machinable bronze for general engineering and structural uses.

1 - - 4 - - - -
TEMPALOY—American Brass Co., Waterbury, Conn. Copper-aluminum-nickel alloys which respond to heat treatment· abrasion resistant. Uses include motor boat shafting, piston rods, bearing applications, etc.

See advertisements, Pages 297-298

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing qualities
7—Electrical properties
8—Machinability

1 2 3 4 5 6 7 8

TENUAL — National Bronze & Aluminum Foundry **Co.. Cleveland.**

1 - - - 5 - 7 -

No. 9; Si 4.50-6.00, low impurities, balance Al; furnished as sand or permanent-mold castings. In untreated state: Ts, 19.000 psi; comp str, 10,000 psi; ys, 9000 psi; elong in 2 in., 5.0 per cent; impact str, 1.0 ft-lb (Charpy); endurance limit (completely reversed bending), 6500 psi; bhn, 40; sp gr, 2.70; nonmagnetic; weldability, good; max cont. serv. temp, 250 F. For various corrosion resisting parts.

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No. 39; Cu 3.5, Si 6.0, balance Al; furnished as sand or permanent-mold castings. In heat-treated state: Ts, 35,000 psi; comp str, 30,-000 psi; ys, 24,000 psi; elong in 2 in., 2.0 per cent; sp gr, 2.77; nonmagnetic; abrasion resistance, high; max cont. serv. temp, 300 F. For general purpose castings.

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No. 50; Cu 8.0, Fe 1.0, Si 1.2, balance Al; furnished as sand and permanent-mold castings. In untreated state: Ts, 23,000 psi; comp str, 14,000 psi; ys, 14 000 psi; elong in 2 in., 2.0 per cent; impact str, 0.6 ft-lb (Charpy); endurance limit (completely reversed bending), 8000 psi; bhn, 65; sp gr, 2.83; max cont. serv. temp, 250 F. For general purpose castings.

- 2 - - - 6 - 8

No. 54; Cu 4.0, Mg 1.5, Ni 2.0. balance, Al; furnished as sand and permanent-mold castings. In heat treated state: Ts, 37.000 psi; comp str. 47.000 psi; ys, 32.000 psi; sp gr, 2.77; nonmagnetic; weldability, good; max cont. serv. temp, 350 F; abrasion resistance, high. For parts subjected to elevated temperatures.

1 - - 4 - - - -

No. 64; Si 7.0, Mg 0.3, balance Al; furnished as sand and permanent-mold castings. In heat-treated state: Ts. 33.000 psi; comp str, 22.000 psi; ys. 24,000 psi; elong in 2 in., 4.0; sp gr, 2.68; nonmagnetic; weldability, good; abrasion resistance, medium; max cont. serv. temp. 300 F. For intricate parts requiring high strength.

1 2 - - - - - -

No. 68: Cu 1.3, Si 5.0, Mg 0.5, balance Al. Furnished as sand castings and permanent-mold castings. In heat-treated state: Ts, 35 0000 psi; comp str, 29 000 psi; ys, 25 000 psi; elong in 2 in., 2.5; sp gr, 2.68; nonmagnetic; weldability good; max cont. serv. temp, 350 F. For castings subjected to elevated temperatures.

- - - 4 5 - - 8

No. 105; Cu 4.0, balance Al; furnished as sand castings. In heat-treated state: Ts. 36 000 psi; comp str, 25 000 psi; ys, 24 000 psi; elong in 2 in., 5.0; impact str, 1.8 ft-lb (Charpy); sp gr, 2.78; nonmagnetic; weldability, good; max cont. serv. temp, 300 F. For castings where design is not intricate and high strength is needed.

1 - - 4 5 - - 8

TERNALLOY—The National Smelting Co., Cleveland.

1 - - 4 5 - - 8

No. 6; Mg 1.8, Zn 3.6, Mn 0.3, Cr 0.3; furnished in rough bars or billets, and as sand, permanent-mold and precision castings. In untreated state: Ts, 35 000 psi; ys, 23 000 psi; elong in 2 in., 4.0; bhn, 75; sp gr, 2.76; nonmagnetic; weldability, good For use where high strength, ductility, dimensional stability and good machinability are required.

- - - 4 5 - - 8

No. 7; Mg 2.1, Zn 4.3, Mn 0.3, Cr 0.3; furnished in rough bars or billets, and as sand, permanent-mold and precision castings. In untreated state: Ts, 36.000 psi; ys, 26,000 psi; elong in 2 in., 2 5 per cent; bhn, 80; sp gr, 2.76; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability and good machinability are required.

1 - - 4 - - - 8

No. 8; Mg 2.3, Zn 4.9, Mn 0.3, Cr 0.3; furnished in rough bars or billets and as sand, permanent-mold and precision castings. In heat-treated state: Ts, 60.000 psi; ys, 56 000 psi; elong in 2 in., 2.5 per cent; bhn, 125; sp gr, 2.78; nonmagnetic; weldability, good. For uses same as Nos. 6 and 7.

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THERMALIZED TRITEX No. 2—La Salle Steel Co., Hammond, Ind. C 0.40-0.48, Mn 1.35-1.65, P 0.04 max, S 0.20-0.32; furnished in finished rods or bars for machining. Induction harden or quench, 1550 F, temper to desired hardness. For lead screws and key shafts, or if heat-treated, gears and shafts.

1 2 - - - - - -

THERMALLOY Cast Steels—Electro-Alloys Division, American Brake Shoe Co., Elyria, O.

Grade A; heat-resistant alloy furnished as sand castings to specification; Ni 64-70, Cr 17-20, Si 1-2, Mn 0.75-1.25, C 0.45-0.65. Nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont. serv. temp, 2000 F. For heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

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Grade 72; heat-resistant alloy furnished as sand castings to specification; C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 12-15, Ni 58-64. In untreated condition: Ts is 62-80 000 psi; ys, 30-40,000 psi; elong in 2 in., 15-3 per cent; bhn, 170-210; nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont. serv. temp, 2000 F. For general furnace parts. heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

1 2 - - - - - -

Grade 50; heat-resistant alloy furnished as sand castings to specification; C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 15-18; Ni 34-37. Ts, 55-75.000 psi; ys. 32-55,000 psi; elong in 2 in., 20-4; bhn, 150-195; nonmagnetic; weldability, fair to good; resists corrosion by hot gases except those high in sulphur; max cont. serv. temp. 2000 F. Used for furnace retorts, heat treating and carburizing boxes, burner parts, conveyor chain, furnace supports, etc.

1 2 - - - - - -

Grade E; heat-resistant alloy furnished as sand castings to specification; C 0.3-0.4, Mn 0.75-1.25, Si 1-1.75, Cr 26-28, Ni 10-13. Ts (untreated), 65-95,000 psi; ys, 36-55.000 psi; elong in 2 in., 30-4; bhn, 170-260; nonmagnetic or weakly magnetic; weldability, good; resists corrosion by hot gases; max cont. serv. temp, 2000 F. For shafts, disks, beams, chain rollers and other heat-treating furnace parts; oil still tube supports; dampers and valves; paper-mill digester parts; burner tips and nozzles; rabble arms, and blades: furnace buggies; lead parts, etc.

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Grade H; heat-resistant alloy furnished as sand castings to specification; C 0 25-0.35, Mn 0.75-1.25, Si 0.75-1.75, Cr 19-22, Ni 7.5-10. Untreated: Ts, 75-100,000 psi; ys, 40-50 000 psi; elong in 2 in., 40-20; bhn, 170-210: nonmagnetic or weakly magnetic; weldability, good; corrosion resistant to hot gases and corrosive liquids; max cont. serv. temp, 1600 F. For mine water and acid pump parts, chemical mixer parts, marine fittings, oil still supports, etc.

1 2 - - - - - -

Grade J; heat-resistant alloy furnished as sand castings to specification: C 0.3-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 27-30, Ni 7-10. Untreated: Ts, 85-110,000 psi; ys, 40-75 000 psi; elong in 2 in., 18-2 per cent; bhn, 200-270; magnetic; weldability, good; resists corrosion by hot gases; max cont. serv. temp 2000 F. Suitable for same type parts as Grade H.

1 2 - - - - - -

Grade L; heat-resistant alloy furnished as sand castings to specification: C 0.3-0.4, Mn 0.75-1.25, Si 1.25-2.25, Cr 24-27, Ni 19-22. Untreated: Ts, 65-95,000 psi; ys, 40-70 000 psi; elong in 2 in., 25-12; bhn, 160-195; nonmagnetic; weldability, good; resists corrosion by hot gases. For general furnace parts and carburizing containers.

1 2 - - - - - -

Grade C; heat-resistant alloy furnished as sand castings to specification; C 0.2-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 26-29, Ni 3.0 max. Untreated: Ts, 65-95.000 psi; ys, 45-55 000 psi; elong in 2 in., 5-0 per cent; bhn, 170-240; magnetic; weldability, fair; resists corrosion caused by hot gases. For lead pots, sintering bars, grate bars and tuyeres, roaster furnace rabble arms and blades.

1 2 3 4 5 6 7 8

THINSTEEL—The Cold Metal Products Co., Youngstown, O. Most grades of carbon and alloy steels in strip form, including stainless steels. For property and application data, see "Stainless Steels" listings elsewhere in this section.

See advertisement, Page 285

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THOMASTRIP—Thomas Steel Co., Warren, O. Cold-rolled strip steel, bright finish electrocoated in brass, nickel, zinc, and copper. Hot-dipped tin and solder. Lacquer coated in colors. Carbon and alloy specialties.

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TIGERLOY—Massillon Steel Casting Co., Massillon, O. Nickel-molybdenum; for shovel castings, gears, crane track wheels, castings for impact resistance etc.

1 2 3 4 5 - - 8

TIMKEN Steels—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. All standard AISI types of alloy and stainless steels in standard forms. Also AISI carbon steels for mechanical tubing. For property and application data on stainless steels, see "Stainless Steels" listings elsewhere in this section.

See advertisement, Page 273

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TI-NAMEL—Inland Steel Co., Chicago 3, Low-carbon alloy steel; furnished in rough bars or billets. finished rods or bars, straight and coiled strip. wire. sheets, plates and tubing; for machining, hot and cold working, stamping, drawing, brazing, and arc, gas and resistance welding. In heat-treated state: Ts, 50 000 psi; ys. 22 000 psi; elong in 2 in., 38 per cent; hardness, rockwell B, 50-60; weldability, good; ductility, high. For food and dairy machinery. beverage machinery, washing machines, refrigerators, stoves, etc.

1 - 3 - 5 - 7 -

TISCO—Taylor-Wharton Iron and Steel Co., High Bridge, N. J.

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Manganese steel; C 1.00-1.40, Mn 11.0 min, Si 1.0 max, S 0.05 max P 0 10 max. Furnished as sand castings. Ts, 80-110,000 psi; ys, 35-45 000 psi: elong in 2 in., 15-35 per cent; bhn, 180-200; nonmagnetic; max cont. serv. temp. 300 F: abrasion resistance. high. For wearing parts for excavating, crushing and reduction machinery.

Timang; manganese-nickel steel; C 0.60-0.80, Mn 13.0-15.0, Ni 2.75-3.25; furnished in finished rods or bars, wire and plate, and as sand castings; for arc welding. Ts, 135-155,000 psi; ys, 45-55 000 psi: elong in 2 in., 50-80 per cent: endurance limit (completely reversed bending), 50 000 psi; bhn, 170-210; nonmagnetic; weldability, good; max cont. serv. temp, 500 F; abrasion resistance, high. For welding rods and abrasion-resisting plates and screens.

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Alnico; magnet metal; of aluminum, nickel, cobalt and iron: furnished as sand castings. In untreated state: Ts. 4197 psi; sp gr, 6.9; highly magnetic; corrosion and abrasion resistance, high. Used for permanent magnets.

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TITAN—Titan Metal Mfg. Co., Bellefonte, Pa.

Bronze welding rods, as follows:

Bronze; flows at 1617 F. is low fuming and has been doubly deoxidized.

Naval bronze; flows at 1615 F.

Wearwell; flows at 1593 F. A special purpose rod possessing great hardness. Rods are not furnished under ¼-in. diam.

These rods are tin bronzes and work well on cast iron; have good hardness, a fair amount of ductility and good corrosion resistance.

Manganese bronze; flows at 1617 F. is low fuming and has been doubly deoxidized.

Naval manganese bronze; flows at 1620 F.

The above two welding rods contain iron, manganese, nickel, etc., in addition to tin. Good general-purpose rods, specifically recommended for cast iron: produce rigid welds; able to withstand distortion.

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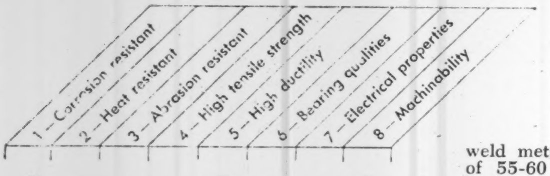
Also following corrosion-resistant rods:

Manganese; a forgeable bronze. Cu 59.25, Mn 0.40, Sn 0.90, Fe 0.90, balance Zn. Conforms to chemical requirements of U. S. Navy Spec. 46B-15-C.

Naval Bronze; forgeable; Cu 60.25, Sn 0.75, balance Zn. Has high strength; is corrosion resistant. For valve parts, etc.

Also produce Muntz Metal (see listing under "Muntz Metal" in this section), free-machining brass and bronze rods.



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TI-NIC-O-SIL Nickel Silver Forging Alloys—Titan Metal Mfg. Co., Bellefonte, Pa.

No. 11: Contains about 10 per cent nickel. Forges with same ease as forging-quality brass. Close forging tolerances can be held. For forged parts requiring white color and good corrosion resistance combined with moderate strength.

No. 15: Has excellent white color; not quite as forgeable as No. 11. Ts, over 85,000 psi Composition: Cu 31-44, Ni 15-20, Zn balance.

No. 10: Nickel-silver; white color; Cu 46.85, Pb 1.50, Fe 1.00, Mn 1.00, Ni 10, balance Zn. Exceptional corrosion resistance; high strength free machining; takes high polish. For hardware, valve parts, bottling machines automobile accessories, electrical contacts, etc.

1 - - 4 5 - - -

TOBIN BRONZE—American Brass Co., Waterbury Conn. Cu 60. Zn 39.25. Sn 0.75; abrasion-resistant. Uses include piston rods, boat shafting. condenser head plates, welding rods, seamless tubes, etc.

See advertisements, Pages 297-298

1 - 3 4 5 - - -

TOLEDO Alloys—Unitcast Corp., Steel Casting Div., Toledo, O.

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No. 4; abrasion-resistant, silicon-molybdenum steel with good hardening properties. Used for mining tools, wear plates, crusher plates and pinions.

No. 6; air-hardening die steel of uniform machining qualities; long life under severe wear.

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No. 131; C 0.22-0.28, Mn 0.7-0.8, Cu 1-1.2, V 0.04-0.08. Si 0.4-0.5; furnished in castings. Ts, 90-100 000 psi, ductility, high. For use where high strength and ductility are required and when hardness is of lesser importance.

1 - - 4 5 - - -

No. 135; C 0.30-0.37, Mn 0.70-0.85, Ni 0.70-0.95, Cr 0.50-0.70, Mo 0.18-0.25; furnished as castings to meet 4B, 4C2, 4C3 Army Specifications. Can be oil or water-quenched. General physical specifications: Ts, 100,000 psi· ductility high; bhn, 217-241; machinability. good.

No. 135H: C 0.37-0.45, Mn 0.70-0.85, Ni 1.00-1.25, Cr 0.70-0.85, Mo 0.25-0.35. Has higher strength and hardenability. Will oil quench to higher and deeper hardness. Used for wear plates. scarifier teeth etc. Machinability, good at 220-260 Brinell.

See advertisement, Page 181

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TOMBASIL—Ajax Metal Co., Philadelphia 23. Material available in two grades.

A; Cu 81.5. Si 4.8. Zn 13.7. In untreated state: Ts. 65 000 psi: ys. 40 000 psi: elong, 15 per cent· bhn 140· sp gr, 8.25; nonmagnetic: weldability, good.

Navy; analysis in accordance with Navy Dept. Spec. 46B28 Cu 90 Si 5 max, Zn 5. In untreated state: Ts. 55 000 psi: ys. 20.000 psi· elong. 40 per cent: bhn. 105: sp gr, 8.25; nonmagnetic; weldability, good.

1 - - - 5 - - -

TONCAN IRON—Republic Steel Corp., Cleveland 1. An open-hearth iron alloyed with 0.40 per cent min copper and 0.05 per cent min molybdenum. Resists corrosion caused by atmosphere. water, oils and process materials ts, 48-58 000 psi min: comp str, 40 000 psi; bhn, 90-120. For sheet-metal applications.

1 2 3 - - - - -

TOOLWELD—Lincoln Electric Co., Cleveland.

Type 60; coated arc welding electrode. deposited hardness of 60-65 rockwell C; hardness retained to 1000 F: deposit can be heat treated same as high-speed steel. For building hard tough cutting edges on cold-rolled steel and for other applications requiring super-hardness.

Type 55; for making metal-cutting edges where shock is encountered (for cutting tools, blades and dies) providing an as-deposited weld metal hardness without heat-treatment of 55-60 rockwell C. While not quite as hard as Type 60. it is somewhat tougher and more shock resistant. Otherwise properties are essentially the same as type 60.

1 2 - - - - 7 -

TOPHET—Wilbur B. Driver Co., Newark, N. J.

Type A; approximately 80 per cent Ni and 20 Cr; resists heat to 2100 F. Supplied in wire and strip form; for electrical heating applications.

Type C; Ni 60, Cr 15, and balance Fe; resists heat to 1800 F. Supplied in wire and strip form; for electrical resistance and heating application.

- 2 3 4 - - - -

TRANTINYL—Youngstown Alloy Castings Corp., Youngstown, O. Furnished as sand castings. High abrasion resistance; medium ductility; high tensile strength. Used for tools for tube and bar mills such as guide shoes, plugs, guides, etc.

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TRIPLE-ALMAG-35—Acme Aluminum Alloys, Inc., Dayton 3, O. Mg, Be, B, Al plus impurities furnished in ingots and sand castings. Ts, 35,-40,000 psi; elong in 2 in., 9-15 per cent. Has high tensile strength, corrosion resistance and ductility.

See advertisement, Page 134

1 - - 4 5 - - -

TRIPLE A ALMAG-55—Acme Aluminum Alloys, Inc., Dayton 3, O. Mg, Be, B, Cu, Si, Fe, Zn, and Al; furnished in ingots and sand castings. In untreated state: Ts, 50,000 psi min; ys, 30,000 psi min; elong in 2 in., 16 per cent min; impact str, 7.5 ft lb av (Charpy); bhn. 90; sp gr. 2.55; resists corrosion caused by atmospheres. Recommended for aircraft applications.

See advertisement, Page 134

1 2 - - 5 - - -

TRENTWELD Stainless Tubing—Trent Tube Mfg. Co., East Troy, Wis. Austenitic stainless steels, in welded tubing. Recommended heat treatment. standard annealing practice for austenitic stainless steels. Ts, 75,000 psi min; ys, 40 000 psi min; elong in 2 in., 35 per cent; hardness, rockwell B, 80 max; nonmagnetic. For use where corrosive environment is such that stainless steels are required.

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TRODALOY—General Electric Co., Schenectady, N. Y. Resistance welding electrode alloys available in two grades.

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No. 1; Co 2.6. Be 0.4, and Cu 97; has 55 per cent conductivity of copper. In heat treated state; ts, 90-120 000 psi; impact resistance, high; bhn, 220. For resistance welding electrodes. soldering iron tips, springs, bushings, castings, brake drums, etc. No sales made through General Electric Co. Various Trodaloy items sold through following licensees: P. R. Mallory Co., Ampco Metal Co., Wilbur B. Driver Co., Electroloy Co. and Welding Sales & Engineering Co.

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No. 7; generally consists of Be 0.1. Cr 0.4 and Cu 99.5· furnished in rough bars or billets, finished rods or bars. wire, strips, plates for hot forging, stamping, extruding, turning, boring and as sand castings. In heat treated state; ts. 45-70 000 psi; impact resistance, high: endurance limit (completely reversed bending). 18-25 000 psi; bhn, 90-140; nonmagnetic. Used for resistance welding electrodes. high conductivity springs and castings, and substitute for P-bronzes.

1 2 3 4 5 6 - 8

TRUALOY—True Alloys Inc.. Detroit 9.

- 2 - 4 5 - - -

Aluminum bronze; Cu 86-89. Fe 2-3, Al 8-10; for sand castings and permanent-mold castings. In untreated state: Ts, 65 000 psi; ys, 28 000 psi; elong in 2 in., 20 per cent; bhn. 135; weldability, good; abrasion resistance, high. For high strength. wearing surfaces under load and low speed.

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Aluminum; Cu 3, Si 4, Al balance; for sand and permanent-mold castings. In untreated state: Ts. 36 000 psi: elong in 2 in., 2 per cent; bhn, 85; weldability, good; resists corrosion caused by salt water; abrasion resistance, medium. For polished castings where high strength, hardness and lightness are required.

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Bearing bronze; Sn 8-10, Pb 15, Cu balance; for sand and permanent-mold castings. In cold-worked state: Ts, 25,000 psi; ys, 12 000 psi: elong in 2 in., 8 per cent; weldability, good; abrasion resistance. high. For bearings under load and low pressure.

1 - - 4 5 - - -

Manganese bronze; Cu 60, Zn 24, Fe 2, Al 4; for sand and permanent-mold castings. In cold-worked state; Ts, 25,000 psi; ys, 12,000 psi elong in 2 in.. 20 per cent; weldability, good· abrasion resistance. medium. For parts requiring high strength with high elongation.

Also produce castings from all SAE, AISI and ASTM castings specifications.

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TRUFLEX Thermostat Metals—General Plate Div., of Metals and Controls Corp., Attleboro, Mass. Available in sheets or strips in long lengths, flattened and coiled. or cut to length—spiral helix or double-helix coils—also fabricated parts. and welded or riveted sub-assemblies with solid-silver or laminated electrical contacts or mounting brackets. For control or indication of temperature and for compensating movement required in assemblies due to changes in temperature.

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TUFTEST—The Medart Co., St. Louis. Cast iron for parts subject to excessive abrasion such as guiding disks; machinability, good.

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TUBELOY—American Smelting & Refining Co., New York. C 0.02. Mg 0.02. Sn 0.25, balance Pb; tubing for extruding. Mechanical properties in untreated state; ts, 4500 psi; elong, 15 per cent· impact resistance, medium: endurance limit (completely reversed bending). 1500 psi; bhn, 9; sp gr, 11.33· weldability, fair· resists corrosion caused by water, gasoline, etc.; abrasion resistance low. Used for conveying water, oil and other types of liquids.

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TY-LOY—W. S. Tyler Co., Cleveland. Special composition metal resistant to abrasive action. Wire screens of this material withstand severe abrasive conditions. Many sizes of square mesh can be made of Ty-Loy.

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U-LOY—Republic Steel Corp., Cleveland 1. Copper-bearing steel with good corrosion resistance. available in hot-rolled and galvanized sheets.

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ULTRA-CUT—Bliss & Laughlin Inc., Buffalo. High sulphur bessemer screw stock furnished in cold finished bars. For miscellaneous automatic screw machine parts.

See advertisement, Page 314

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UNITED AMERICAN BABBITTS — United American Metals Corp., Brooklyn 22, N. Y.

Government genuine babbitt; furnished in bars. In cold-worked state: Ts, 7100 psi; comp str, 18 250 psi; ys, 7700 psi; elong in 2 in.. 0.015 per cent· bhn, 28.3. For heavy-duty high-speed engines.

Diesel marine genuine babbitt; furnished in bars. In cold-worked state: Ts. 9760 psi; comp str, 11 740 psi; ys, 7700 psi: elong in 2 in., 0.11 per cent· bhn, 24.8. For diesel type marine engines.

Manganese babbitt; furnished in bars. In cold-worked state: Ts 11 [illegible]60 psi· comp str, 19 450 psi; ys, 8000 psi; elong in 2 in., 0.015 per cent; bhn, 21. For general heavy service.

1 2 3 4 5 - 7 -

U.S.S.—United States Steel Corp., subsidiaries, including American Steel & Wire Co., Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co.. Tennessee Coal, Iron & Railroad Co., and Tubular Alloy Steel Corp.

Standard stainless steels in following grades: Types 302, 303, 304, 309, 316, 321, 347, 410. 416. 430. 446. 501. and 502. For property and application data, see "Stainless Steels" listing elsewhere in this section.

1 2 - - - - - -

Shelby 5-per cent chrome-molybdenum tubing. Used for furnace tubes in oil-cracking stills,

1—Corrosion resistant
2—Heat resistant
3—Abrasion resistant
4—High tensile strength
5—High ductility
6—Bearing qualities
7—Electrical properties
8—Machinability

condensers and superheaters where high temperatures and pressures, and corrosive fluids are handled. Cr 0.15 max, Mn 0.5 max, Si 0.5 max, C 4-6 and Mo 0.45-0.65.

Shelby tubing may be obtained in many additional grades from the lowest carbon boiler tube steel to the stainless grades of alloy steel which are available in tubing in all sizes up to 10¾ in. OD. A number of steels made to SAE standards are also furnished in Shelby tubing.

1 2 3 - - - - -
Castings furnished by Lorain Div.:

Type A-1; C 0.3-0.4, Cr 0.75-1, Ni 2.5-3, Mn 0.6-0.8, and Mo 0.3-0.4.

Type A-3; C 0.45-0.55, Cr 0.75-0.9, Ni 0.6-0.8, Mn 1.5-2, and Mo 0.3-0.4.

Type MS-1; C 1.4, Mn 10-14, with or without Cr 0.75-1.

- - - - 5 - 7 -
Electrical steel sheets for use in transformers, motors and generators; eleven principal grades of electrical sheets furnished—U.S.S. Pole, Field, Armature, Electrical, Motor Dynamo, Radio Transformer 72, and Transformer 72, 65, 58 and 52.

1 - - 4 - - - -
Other materials are furnished as follows: Carnegie-Illinois Steel Corp., Columbia Steel Co., Tennessee Coal, Iron & Railroad Co., and United States Steel Supply Co. in stainless steel in sheets, plates, shapes and bars; National Tube Co., and Tubular Alloy Steel Corp. in pipe and tubular shape; and American Steel & Wire Co. in strip and wire forms.

See advertisements, Pages 133, 157

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U.S.S. AR STEEL (Abrasion Resisting Steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco, and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. C 0.35.5, Mn 1.5-2, P 0.05 max, S 0.055 max, Si 0.15-0.3, furnished in bars, sheets, strip, plates and shapes; high abrasion resistance; bhn, approx., 200-275 as rolled, heat-treated, 350-450. Used for wear resisting surfaces.

See advertisement, Page 157

- - 3 4 - 6 - -
U.S.S. CARILLOY—Carnegie-Illinois Steel Corp., Pittsburgh. Alloy steels in all standard grades of AISI and SAE steels sold under the above tradename.

See advertisement, Page 157

1 - - 4 5 - - -
U.S.S. COR-TEN—Carnegie-Illinois Steel Corp., Pittsburgh, Columbia Steel Co., San Francisco; Republic Steel Corp., Cleveland 4; and Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. C 0.12 max, Mn 0.2-0.5 max, P 0.07-0.15, Si 0.75 max, Cu 0.3-0.5, Cr 0.50-1.25; furnished in bars, sheets, strip, plates structural and bar shapes, for hot and cold forming, welding, riveting, etc. Resists atmospheric corrosion four to six times that of plain carbon steel; abrasion resistance, good; ys 50 000 min; ts 70 000 psi min. with high ductility; weldability, good. Used for light-weight construction, where atmospheric corrosion-resistance is a major factor; structural and body members on mobile equipment.

See advertisement, Page 157

1 - 3 4 - - - -
U.S.S. MANG-NI CU Steel—Carnegie-Illinois Steel Corp., Pittsburgh 30. C 0.25 max, Mn 1.50 max. P 0.08 max. S 0.05 max. Si 0.25 max. Cu 0.25-0.50, Ni 0.50-1.00. Furnished in rough bars or billets. finished rods or bars strips (coiled). sheets. plates and structural shapes. for hot and cold forming, riveting etc. Resistance to corrosion 3 times that of plain carbon steel; abrasion resistance, good; ductility, good; weldability, good; ys. 50 000 psi min; ts. 70 000 psi min. Used for lightweight construction where atmospheric corrosion and welding are of major importance.

See advertisement, Page 157

- - 3 4 - - - -
U.S.S. MAN-TEN—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal. Iron & Railroad Co., Birmingham, Ala. C 0.25 max, Mn 1.1-1.6, P 0.04 max, S 0.05 max, Si 0.3 max, Cu 0.2 min; furnished in bars, sheets, strip, plates, structural and bar shapes for hot and cold forming, welding and riveting. Corrosion-resistant; high abrasion resistance; ys, 50 000 psi min; ts. 75.000 psi min. Used for lightweight construction where atmospheric corrosion resistance is not a major factor.

See advertisement, Page 157

1 - - - 5 - 7 8
U.S.S. Sheets—Carnegie-Illinois Steel Corp., Pittsburgh, 30.

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Paintbond; galvanized steel sheet for stamping and forming into cases, cabinets, etc.

Galvannealed; galvanized steel sheet for stamping and forming into cases, cabinets, air ducts, dust collectors, etc.

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Vitrenamel; sheet for porcelain enameled jackets, casings, trays, cabinets, etc.

- - - - - - 7 -
Electrical Sheets; also strips, for parts requiring electrical properties. Copper Steel; available in strip, sheet and plate for general sheet metal parts.

Hot-Rolled Sheets and Strips; for sheet metal parts where finished appearance is of secondary importance.

Cold-Rolled Sheet; for sheet metal parts requiring severe forming and where good finish is important.

Also Galvanized sheets and Long Terne sheets.

See advertisement, Page 157

1 2 - 4 - - - -
U.S.S. STAINLESS STEELS—Carnegie-Illinois Steel Corp., Pittsburgh 30. Stainless steels in standard forms to AISI Specs. 302, 303, 304, 309, 310, 316, 321, 347, 403, 405, 410, 416, 430, 446, 501 and 502. For property and application data on these, see "Stainless Steels" listing elsewhere in this section.

See advertisement, Page 157

1 2 3 4 5 - 7 -
UNIVAN—Union Steel Casting Div., Blaw-Knox Co., Pittsburgh. Nickel-vanadium alloy. Ts, 90 000 psi. For locomotive frames, crossheads, coupling boxes, etc.

V, W

- - 3 4 5 6 - -
VANADIUM — Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa. Available in Types D, G, H, K, N and BB with analyses of C 0.50-1.00, Si 0.25, Mn 0.30, Cr 0.80-1.20 and V 0.20; furnished in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod; for precision casting, machining, hot and cold working, stamping, drawing and brazing. Water or oil-quench, depending upon carbon content, 1425-1550 F; temper 300-1300 F. Hardness rockwell C, 55-67 max, depending on carbon content. Magnetic; weldability fair; max cont. serv. temp. 300-500 F. For bearings and high grade machine parts.

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VASCO Nonshrinkable—Anchor Drawn Steel Co., Latrobe Pa. Oil-hardening drill rods which retain size and shape after hardening and tempering. For small cams and gears, etc.

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VECTOLITE—General Electric Co., Schenectady, N. Y. Nonmetallic, nonconducting magnet material; hardened, sintered combination of iron rust and cobalt oxide mixed when still in powder form. Light in weight and nonconductive properties prevent electrical losses. Have high coercive force or resistance to demagnetizing forces.

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VELVETOUCH—The S. K. Wellman Co., Cleveland O. Bimetallic friction materials consisting of a combination of various powdered metals such as copper, tin, lead and other powdered materials compressed, sintered and welded to a solid metal backing for support. Applications include clutch and brake facings, clutch disks, thrust bearings, etc.

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VERTEX—Metal & Thermit Corp., New York 5. Arc welding electrode for general machine part use. Weld deposit: Ts, 62-700 psi; ys, 52-60,000 psi; elong in 2 in., 22-30 per cent.

1 - 3 4 - 6 7 -
VICULOY Beryllium Copper—The Akron Bronze and Aluminum Co., Akron, O.

1 - - 4 - - 7 -
No. 1; Beryllium copper sand castings, heat-treated at foundry. Ts, 85-90,000 psi; ys, 60-70,000 psi; elong in 2 in., 4-12 per cent; bhn, 200-220; electrical cond, 50-55; nonmagnetic; weldability, poor; abrasion resistance, medium; corrosion resistance equal to copper. For gears, pinions, flash welding dies, trolley shoes and wheels, boat shafting, welding wheels, marine hardware and fittings.

1 - - 4 - - 7 -
No. 2; Beryllium copper sand castings heat-treated at foundry. Ts, 45-50,000 psi; ys, 30-35,000 psi; elong in 2 in., 17-22 per cent; bhn, 120-140; electrical cond, 65-70; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance equal to copper. For circuit breaker parts, current carrying terminals, sliding contacts, burner and current collecting nozzles, spot-welding tips and wheels, etc.

- - 3 4 - 6 - -
No. 3; Beryllium copper sand castings heat treated at foundry. Ts, 170,000 psi; ys, 120,000 psi; elong in 2 in., 2.8 per cent; bhn, 370-400; electrical cond, 20-25; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance about same as copper. For gears, rocker arms, die molds, precision bearings and bushings, etc.

1 2 3 - - - - -
VITALLIUM—Austenal Laboratories Inc., N.Y.C., and Chicago. Precision-casting, high-strength alloy of Co 65, Cr 30, Mo 5, C 0.20-0.40. Furnished as precision castings to specification. Untreated: Ts, 90-110 000 psi; ys, 52-85 000 psi; elong in 2 in., 5-15 per cent; hardness, rockwell C, 20-36; nonmagnetic; weldability, good; abrasion resistance, high; resists hot or cold nitric acid, all strengths, hot exhaust gases of leaded fuels, sodium chloride, most organic acids, cold dilute hydrochloric and sulphuric acids. Max cont. serv. temp. 1500 F (under load). For parts requiring high strength corrosion resistance and wear resistance at elevated temperatures.

See advertisement, Page 307

- - - 4 - 6 - 8
WAUKESHA Metals—Waukesha Foundry Co., Waukesha, Wis. Copper-base high-nickel content alloys available in 20 different grades; furnished as sand castings for machining into parts. Ts. up to 105 000 psi; elong in 2 in., from less than 1 to 34 per cent; hardness, brinell (3000 kg), from 93 to 264; resists corrosion caused by dairy, food, beverage and canning products, and salt solutions. For all parts contacting dairy, food, beverage and cannery foods.

- - - - 5 - - -
WEIRALEAD—Weirton Steel Co., Weirton, W. Va. Ductile sheets with excellent welding characteristics. Its tight hot dipped coating serves as a die lubricant and takes deep drawing successfully. It also provides a satisfactory base for paint, lacquer or varnish.

- - - - 5 - - -
WEIRZIN—Weirton Steel Co., Weirton, W. Va. Electrolytic zinc-coated sheets and strip. Sheets 32½ in. wide (available in coils or cut lengths) down to ⅜-in. strip. Adaptable to a wide variety of uses where the protection of a zinc coated material is required. This material is a high quality ductile steel with bonded coating, for deep drawing.

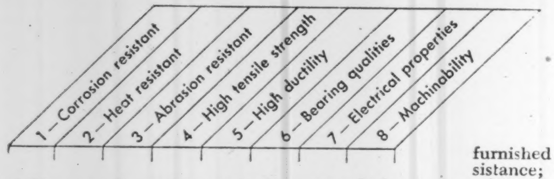
1 2 - 4 5 6 7 8
WELBRONCO—The Wellman Bronze & Aluminum Co., Cleveland. Copper-base, aluminum and magnesium sand castings to specifications.

- - - 4 5 - - -
WELDRAWN Tubing—Superior Tube Co., Norristown, Pa. Welded tubing, cold-drawn to give properties of seamless. Available in certain grades of stainless and in nickel and Monel.

1 2 - 4 5 6 7 8
WELLCAST—The Wellman Bronze & Aluminum Co., Cleveland. Copper-base, aluminum and magnesium sand castings to specifications.

- - - - 5 6 7 8
WEL-MET—The Wel-Met Co., Kent, Ohio.

- - - - - 6 - 8
Sintered iron; Fe 90, Cu 10; furnished in rough bars and billets, plate, powder metal and in finished parts. Ts. 25 000 psi; comp str, 30,000 psi; bhn, 50; sp gr, 6.0; weld-



ability, good; resists corrosion caused by alkalies; max cont. serv. temp, 300 F as bearing, and 1500 F as machine parts. For self-lubricating bearings and machine parts.

- - - - 5 6 7 8

Sintered bronze; Cu 85, Sn 8 and Pb 5; furnished in rough bars or billets, plate, powder metal and in finished bushings or machine parts. Ts, 10,000 psi; comp str, 12,500 psi; elong in 2 in., 5 per cent; bhn, 35; sp gr, 60; nonmagnetic; weldability, good; resists corrosion caused by acids in concentrations normally occurring such as mine water; max cont. serv. temp, as lubricated, 300 F; abrasion resistance, low. For self-lubricating bushings, filters and other applications where controlled porosity is required.

- - - 4 5 - 7 -

WESTERN—Western Brass Mills, Div. of Olin Industries Inc., East Alton, Ill. Copper-base alloys (Western Brass, Western Copper, Western Super-X Phosphor Bronze, Western Super-X Nickel Silver); furnished in straight and coiled strip and sheet; for machining, hot and cold working, stamping, drawing, arc, gas and resistance welding, and brazing. Good electrical properties.

1 - 3 4 5 - 7 -

WESTERN SUPER-X—Western Brass Mills Div., Olin Industries, Inc., East Alton, Ill.

1 - - 4 - - 7 -

Grade B; 18 per cent nickel-silver; (nominal) Cu 55, Ni 18, Zn remainder; in strips (coiled), sheets and plates, for stamping, forming and drawing. In untreated state: Ts, 99 500 psi; elong, 4 per cent; hardness, 95 rockwell B; nonmagnetic; weldability, good. For springs, switch blades, contacts, radio parts, etc.

1 - - - 5 - 7 -

Grade A; 18 per cent nickel-silver; (nominal), Cu 72, Ni 18, Zn remainder; in strips (coiled), sheets and plates, for stamping, forming and drawing; ts, untreated, 78,500 psi; elong, 5 per cent; hardness 85 rockwell B; nonmagnetic; weldability, good. For dairy equipment, musical instruments, deep-drawn shells and tubes.

1 - - 4 - - 7 -

Grade E; phosphor-bronze; (nominal), Cu 96.5, Sn 3.5; available in coiled strips and plates, for stamping, forming and drawing. Untreated, ts, 79,500 psi; elong, 8 per cent; hardness, 87 rockwell B; density, 0.320 lb per cu in.; nonmagnetic. For fuse clips, spring clips, vibrator springs, etc.

Grade C; phosphor-bronze; (nominal), Cu 92, Sn 8; available in coiled strips and plates, for stamping, forming and drawing. For metal rolled 4 B&S numbers hard, in untreated state: Ts, 93 500 psi; elong, 13 per cent; hardness, 94 rockwell B; density, 0.310 lb per cu in.; nonmagnetic. For springs, diaphragms, contacts, etc.

1 - 3 4 - - - -

Grade A; phosphor-bronze; (nominal) Cu 95, Sn 5; furnished in strips and plates for stamping, forming and drawing. For metal rolled 4 B&S numbers hard, in untreated state: Ts, 79 500 psi; elong, 8 per cent; hardness, 87 rockwell B; density, 0.320 lb per cu in.; nonmagnetic: abrasion resistance, high. For springs, contacts, diaphragms, fuse clips, bellows, clutch disks, etc.

- - - - - - 7 -

WILCO—H. A. Wilson Co., Newark 5, N. J. Contact materials: silver, tungsten, sintered powder metal, platinum, and alloys. Also thermostatic bimetal, for all temperature ranges, deflection rates and electrical resistivities, and silver-clad steel-jacketed wire, or silver on copper, Invar or other combinations requested.

1 - - - 5 6 - -

WOLVERINE—Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., Detroit.

1 - - - - 6 - -

Aluminum brass: Cu 76, Zn 22, Al 2; furnished in tubing. Corrosion-resistant; medium abrasion-resistant: ts 52-100 000 psi. For bushings, condenser tubing, etc.

Phosphorus-bearing Admiralty brass: Cu 70, Zn 29, Sn 1, residual phosphorus 0.001-.01; furnished in tubing. Medium abrasion resistance; ts, 48-90,000 psi. For condenser tubing.

1 - - - - 6 - -

Phosphorized arsenical Admiralty brass; Cu 70, Zn 29, Sn 1, P 0.015 max, As 0.35 max; furnished in tubing. Corrosion-resistant. For condenser tubing.

1 - - - - - - -

70-30 brass; Cu 70, Zn 30; furnished in tubing. Corrosion-resistant; medium abrasion-resistance; ts, 48-88,000 psi. Used for condenser tubing.

1 - - - 5 - - -

Red brass; Cu 85, Zn 15; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 40-69,000 psi; high ductility. For condenser tubing.

1 - - - - 6 - -

Common high-brass; Cu 66, Pb 0.65 max, Zn balance; furnished in tubing. Corrosion resistant; medium abrasion resistance; ts, 48-85,000 psi. For cupped, formed or drawn parts, etc.

1 - - - 5 - - -

Copper, oxygen-free; Cu and Ag 99.9 min, P 0.015-0.035 (optional as deoxidizer); furnished in tubing. Corrosion-resistant; ts, 31-60,000 psi; high ductility. For condensers, evaporators, heaters, condenser tubes, etc.

1 - 3 - - - - -

Cupro-Nickel; Cu 70, Ni 30; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 65-110,000 psi. For condenser tubing.

Copper, arsenical; Cu and Ag 99.2 min; P 0.015-0.035, As 0.15-0 50; balance is the same as oxygen-free copper.

Commercial bronze; Cu 90, Zn 10; furnished in tubing. Corrosion-resistant; available in color; medium abrasive resistance; ts, 36-63.000 psi; high ductility. For ornamental purposes.

Low brass; Cu 80, Zn 20; furnished in tubing. Resists corrosion; medium abrasive resistance; high ductility; ts, 43-78,000 psi. For bellows, ornamental purposes and fabricated parts.

1 - - - - 6 - -

High brass (2 & 1); free turning; Cu 66, Pb 1.75, Zn balance; furnished in tubing. Corrosion-resistant; medium abrasion resistance; ts, 48-85,000 psi; machinability. For screw machine parts and fabricated parts.

1 - - - - - - -

Naval brass; Cu 60, Sn 0.75, Zn balance; furnished in tubing. Corrosion and abrasion resistant; ts, 55-100,000 psi. Used where corrosion resistance with high strength is required.

Muntz metal; Cu 60, Zn 40; furnished in tubing. Corrosion and abrasion resistant: ts, 48-85,000 psi. For condenser tubes, etc.

Aluminum 2S; Al 99; furnished in tubing. Ductility, high; ts, 13-24,000 psi; machinability, poor. Used for airplane parts, oil burners, etc., where light weight is important.

Aluminum 3S; Al 97, Mn 1.25; furnished in tubing. Ductility, good; ts, 16-29,000 psi; machinability, good. Used for airplane parts, oil burners, etc., where light weight is desired.

See advertisement, Page 279

- - 3 4 5 - - -

WORCESTER Wire—Worcester Wire Works, Division of National Standard Co., Worcester, Mass. Steel wire in small diameter sizes, down to 0.006-in., low and high carbon content. Annealed, hard drawn, tempered, bright, lacquer finish, tinned, copper coated, cadmium coated, and galvanized.

See advertisement, Page 138

1 - 3 - - - - -

WORTHITE—Worthington Pump & Machinery Corp., Harrison, N. J. Ni 24, Cr 20, Mo 3, Si 3.25, C 0.07 max. Cu and Mn 2, Fe, bal; furnished in finished rods or bars and as sand and centrifugal castings for turning, boring, welding, etc. Corrosion-resistant; heat resistance, 2000-2200 F; high resistance to most acid slurries; ts, 97,000 psi, hot rolled, 72,000 psi, sand cast; medium ductility; sp gr, 7.85; bhn, 150-190. Used for pumping equipment, valves, pipe fittings and special apparatus for corrosion resistance.

- - 3 - - - - -

WYCKOFF—Wyckoff Steel Co., Pittsburgh. Cold-finished steel, controlled carbon and alloy steels; turned, polished, ground and polished shafting; annealed, strain and stress relieved, heat-treated, quenched and tempered steels; wide flats up to 12 x 2 in.

1 - - 4 5 - - -

YOLOY—The Youngstown Sheet & Tube Co., Youngstown, O. C 0.05-0.40, Mn 0.3-1.0, Ni 0.75-3.75, Cu 0.40-1.75; special service alloy steel furnished in rough bars or billets, finished rods or bars, tubing, sheets, coiled strip, and plates, for hot forging, stamping, extruding and welding. In untreated state: Ts, 70.000 psi and up, depending on carbon and manganese content; ys, 50.000 psi min; impact resistance, high; weldability, excellent; good machinability.

- - 3 - - 6 - -

Z-METAL—Ferrous Metals Corp., New York 22. C 2.00-2.60, combined C 0.30-0.80, Si 0.90-1.20, Mn 0.70-1.25. In heat-treated state: Ts, 65-100 000 psi; ys, 45-65 000 psi; elong, 8-18 per cent in 2 in.; bhn, 170-207; magnetic; resists corrosion caused by salt water, etc.; max cont. serv. temp, 1000 F; abrasion resistance, high. For chain links, sprockets, levers, gears, cams, connecting rods, cranks, pump parts, hydraulic jack bodies, elevator buckets, etc.

1 - - 4 5 - - -

ZAMAK—New Jersey Zinc Co., New York. Zinc alloys for die cast parts.

No. 2; Al 4.1, Cu 2.7, Mg 0.03, remainder Horse Head Special zinc.

No. 3; Al 4.1, Mg 0.04, remainder Horse Head Special zinc.

No. 5; Al 4.1, Cu 1.0, Mg 0.04, remainder Horse Head Special zinc.

See advertisement, Page 166

1 - - 4 5 - - -

ZILLOY—The New Jersey Zinc Co., New York. Rolled zinc alloys containing approximately 1 per cent copper. Furnished in sheets and strips for forming and stamping.

See advertisement, Page 166

1 - - - 5 - - -

ZINCGRIP—American Rolling Mill Co., Middletown, O. Galvanized sheet iron or steel, in strips or coils, with unusual forming and drawing qualities; for use wherever severe forming makes ordinary galvanized sheet metal unsatisfactory. Also supplied with a Paintgrip treatment.

- - - - 5 - - -

Hot and cold-rolled steels; obtainable in ARMCO ingot iron and ARMCO high-tensile steel, copper-bearing steel and varying analyses of medium and low carbon steel. Available in sheet form; for severe forming requirements.

1 - - - 5 - - -

Long ternes; lead-tin, hot-dip coated sheets with ingot iron, mild steel, or high-tensile steel base metal. For deep drawing requirements and paintability.

Spiral-welded pipe, in wall thicknesses of 7/64 to ½ inch, diameters 6 to 36 inches and lengths up to 50 feet; supplied mill coated, galvanized or bituminous coated and lined. Available in standard or custombuilt fittings. Base metal mild or high tensile steel.

1 - - - 5 - - 8

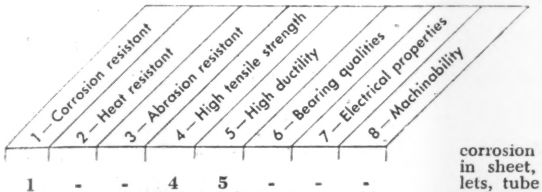
ZIRMET—Foote Mineral Co. Inc., Philadelphia 44. 99+ per cent ductile zirconium metal; furnished in rough bars or billets, finished rods or bars, wire and sheet; for machining, cold working, stamping, drawing and resistance welding. In heat-treated state: Ts, 40 000 psi; sp gr, 6.5; nonmagnetic; machinability, good. For acid-resistant or alkali-resistant parts, also vacuum tube elements.

1 2 - - - - - -

ZORITE—Michiana Products Corp., Michigan City, Ind. Ni 35, Cr 15; furnished as sand castings. Ts, 63 500 psi; ys, 36 500 psi; elong, 5 per cent; bhn, 168; slightly magnetic; weldability, good; heat resistant to 2200 F; abrasion resistance, medium. For furnaces, heaters, electrical resistances.

Stainless Steels

(Standard stainless steels classified by AISI types. These steels, as produced by various companies, are included in the tradename listings commencing on Page 168)



1 - - 4 5 - - -

Type 301; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only; ts, 75-270,000 psi; ys, 30-180,000 psi; elong in 2 in., 40-5 per cent. Furnished in rods, bars, billets, wire, sheet, plate, strip and tubing. For parts requiring good corrosion resistance combined with high tensile strength and good ductility.

1 2 - 4 - - - -

Type 302; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only, ts, 85-300,000 psi, ys, 30-280,000 psi, elong in 2 in., 60-5 per cent; fair machinability; excellent cold forming and welding properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts in acid handling, food and dairy equipment. Shafting, bearing plates, heat exchanger tubes, hydraulic tubing, piston rods, plungers, etc.

1 - - - 5 - - 8

Type 303; Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only; ts, 85-150,000; ys, 35-135,000; elong in 2 in., 55-10 per cent; good machinability; fair cold forming and welding properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For working parts in pumps and valves which must resist corrosion. For screw machine parts requiring strength plus good corrosion resistance.

1 2 - 4 - - - -

Type 304; Cr 18, Ni 8 (18-8 type), austenitic, hardenable by cold work only; ts, 85-250,000 psi; ys, 30-225,000 psi; elong in 2 in., 60-5 per cent; slightly better corrosion resistance than Type 302. Furnished in rods, bars, billets, wire, sheet, plate, strip, tubing and castings. For parts in chemical equipment such as shafting, bearing plates, heat exchanger tubes, etc.

1 2 - - 5 - - -

Type 308; Cr 20, Ni 10 (20-10 type), austenitic, hardenable by cold work only; ts, 80-130,000 psi; ys, 25-45,000 psi; elong in 2 in., 80-55 per cent. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes and castings. For parts in chemical equipment; shafting, bearing plates, etc. Also welding rods.

1 2 - 4 - - - -

Type 309; Cr 25, Ni 12 (25-12 type) austenitic, hardenable by cold work only; ts, 95-190,000 psi; ys, 45-175,000 psi; elong in 2 in., 50-5 per cent; resists scaling to 2000 F, fair machinability, good cold forming properties and excellent weldability. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts that must operate continuously at high temperatures. Oil burner parts, furnace parts, heat exchangers, air heaters, baffle plates, etc.

1 2 - 4 - - - -

Type 310; Cr 25, Ni 20 (25-20 type), austenitic, hardenable by cold work only; ts (annealed), 95-100,000 psi; ys, 40-60,000 psi; elong in 2 in., 55-45 per cent; good welding, drawing and stamping properties; fair machinability. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts subject to intermittent heating and cooling. Oil burner parts, heat exchangers, dye house, paper mill and chemical plant equipment.

1 2 - 4 - - - -

Type 316; Cr 18, Ni 12, Mo 3, (18-12-3 type) austenitic, hardenable by cold work only; ts, 80-225,000 psi; ys, 35-200,000 psi; elong in 2 in., 55-5 per cent; fair machinability, excellent welding and cold forming properties. Best creep strength at high temp and best corrosion resistance of all grades. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For parts requiring high corrosion resistance and high creep strength at elevated temperatures.

1 2 - 4 - - - -

Type 317; Cr 18, Ni 12, Mo 4, (18-12-4 type) austenitic, hardenable by cold work only; ts, 75-100,000; ys, 30-50,000; elong in 2 in., 60-40 per cent (annealed). Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes, castings. For parts for equipment in paper industry; shafts, bearing plates, piston rods, etc.

1 2 - 4 - - - -

Type 321; Cr 18, Ni 8, Ti 4 x C min; austenitic, hardenable by cold work only; ts, 80-190,000 psi; ys, 30-175,000 psi; elong in 2 in., 55-5 per cent; fair machinability, excellent welding and cold forming properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

1 2 - 4 - - - -

Type 347; Cr 18; Ni 8, Cb 8 x C min; austenitic, hardenable by cold work only; ts, 85-190,000 psi; ys, 35-175,000 psi; elong in 2 in., 50-5 per cent; fair machinability, excellent welding and cold forming properties. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

1 2 - 4 - - - -

Type 403; Cr 12 (straight chromium type) hardenable by heat treatment; ts, 100,000; elong in 2 in., 30 per cent; bhn, 202-241; high impact resistance and elastic limit. Furnished in bar stock and wire. For parts in turbine construction; steam turbine blades.

1 2 - 4 - - - -

Type 405; Cr 12, Al 0.1-0.3 (12-Al type) not appreciably hardenable by heat treatment; ts, 60-75,000; ys, 35-50,000; elong in 2 in., 40-24 per cent; is non-air-hardening. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes and castings. For parts requiring welding, annealing boxes, quenching racks, oxidation-resistant partitions.

- 2 - 4 - - - 8

Type 410; Cr 12 (straight chromium type), hardenable by heat treatment; ts, 75-190,000 psi; ys, 40-150,000 psi; elong in 2 in., 35-15 per cent; good machinability and cold forming properties, good welding properties when annealed. Most popular forging grade of stainless. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Used where corrosion is not severe, for bolts, nuts, shafting, turbine blading, valve trim and heat treated parts where hardness and toughness are desired.

1 2 - 4 - - - -

Type 414; Cr 12, Ni 2, (12-2 type), hardenable by heat treatment; magnetic; ts, 119,000 psi (approx); ys, 94,000 psi (approx); elong in 2 in., 25 per cent (approx); good corrosion resistance. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Knife blades, tempered rules, straight edges, scraper knives, mild springs, etc. Parts requiring better corrosion resistance and higher strength than Type 410.

- - 3 - 5 - - 8

Type 416; Cr 12 (straight chromium type with sulphur or selenium added); excellent machinability; ts, 75-185,000 psi; ys, 40-145,000 psi; elong in 2 in., 30-10 per cent; fair cold forming properties; fair corrosion resistance. Furnished in bar, rod, forging billets, wire, cold drawn shapes. For mass production machined parts. Carburetor, instrument and electrical parts. Excellent for screw machine parts.

1 - 3 4 - - - -

Type 420 and 420F; Cr 13, C 0.35 (straight chromium type), highly hardenable by heat treatment; ts, 95-250,000 psi; ys, 60-200,000 psi; elong in 2 in., 30-5 per cent; fair machinability and cold forming properties; good corrosion resistance. Type 420F is free machining. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, and structural shapes. Generally used for hard, keen, knife edges for cutlery and surgical instruments.

1 2 - - 5 - - -

Type 430; Cr 17 (straight chromium type), nonhardenable by heat treatment; resists scaling to 1500 F; excellent cold heading properties, excellent machinability, does not discolor in atmosphere. Ts, 70-110,000 psi; ys, 40-90,000 psi; elong in 2 in., 35-10 per cent. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. For press plates, oil burner parts, screw machine parts, trim for automobiles such as body moldings, hub caps, finishing washers, gas tank caps, etc. Also trim for appliances.

1 - - - 5 - - 8

Type 430 F; Cr 17 with 0.07 S or Se; (straight chromium free machining type), nonhardenable by heat treatment; ts, 85-110,000 psi; ys, 55-90,000 psi; elong in 2 in., 27-8 per cent; excellent machinability, fair cold forming properties. Furnished in forging billets, hot-rolled and cold-finished bars, wire and polished shafting. Particularly suitable for parts requiring considerable machining and which need only moderate corrosion resistance. Screw machine parts.

1 2 - 4 - - - -

Type 431; Cr 16; Ni 2; (straight chromium type), hardenable by heat treatment; ts, 110-230,000 psi, ys, 85-165,000 psi; elong in 2 in., 20-10 per cent; good machinability; fair cold forming properties; resists scaling to 1500 F. Best corrosion resistance of all hardenable stainless steels. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts requiring excellent physical properties coupled with high corrosion resistance.

1 - - 4 - 6 - -

Type 440 C and 440 A, B and F; Cr 17, C 1.00 (straight chromium type), hardenable by heat treatment; ts, 105-275,000 psi; ys, 60-225,000 psi; elong in 2 in., 15-2 per cent; fair machinability and cold forming properties. Types A and B are of same analysis except for lower carbon content, thus are less hardenable. Type F is free machining. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. Needle valves, ball check valves, ball bearings, scissors, rules, cutlery, etc.

1 2 - 4 - - - -

Type 442; Cr 20, Cu 1; hardenable by cold work only; magnetic; annealed. Approx properties are: Ts, 90,000 psi; ys, 50,000 psi; elong in 2 in., 22 per cent. Resists scaling to 1600 F. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes and structural shapes. Scale resistant parts such as in furnaces, soot blower tubes, stirring rods and ladles for molten nonferrous metals.

1 2 - - 5 - - -

Type 446; Cr 27 (straight chromium type), nonhardenable by heat treatment; ts, 75-85,000 psi; ys, 45-60,000 psi; elong in 2 in., 35-30 per cent; resists scaling to 2000 F; corrosion resistance equal to 18-8. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts requiring moderate strength when operating at high temperatures. Valves and fittings, baffle plates, heaters, oil burner parts, etc.

1 2 - 4 - - - -

Types 501 and 502; Cr 4-6, Type 501 has over 0.10 C; Type 502 has 0.10 C max. Otherwise analyses are identical. Hardenable by heat treatment; magnetic; ts, 60,000 psi min; ys, 25,000 psi min; elong in 2 in., 30 per cent min. Heat and corrosion resistance between that of plain steels and the high chromium and chromium-nickel steels. Furnished in sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes. For parts in high temp service; oil refinery and chemical equipment.

Index of Alloys by Principal Constituents

OFTEN the engineer responsible for design selects the material for a machine part according to the base metal and certain alloying elements which are known to influence the properties in a desired direction. To provide the designer with a key between alloying constituents and tradenames the accompanying cross-reference index has been compiled. Further information on each alloy may be obtained by referring to the alphabetical listing by tradenames under "metals", commencing on Page 168.

Tradenamed alloys are indexed primarily under the base metal or predominating element or, in some cases such as bearing metals, under the primary use. Alloying elements which control the properties of the material are arranged alphabetically as subheads under the main heads. In a few cases additional controlling elements are added in italics.

IRON & STEEL

C

Agaloy tubing
Amercut
American Quality
Aristoloy
Athenia
Bethlehem
Blue Anchor
Bundyweld
Colonial
Continental
Cumberland
Dodge
Elastuf
Farrell
Fivepoint Deephard
Fort Howard
Globe
Graphitsteel
Inland
J & L
Jalcase
Keystone
Michigan
Midvale
Page Wire
Pittsburgh
Sharon
Standard
Summerill
Thinsteel
Timken
Ultra-cut
Union
U. S. S. Carilloy

Cr

Abrasist
Allegheny Metals
Almet
Armco
Aristoloy
B & W Croloy
Bethlehem
Carpenter
Chromeweld 4-6
Circle L
Cooper
Duraloy
Duro Gloss
Eis 45
Electrunite
Enduro
FS
Globe
Gold Anchor
Haynes Stellite (*WCo*)
Ingersoll
Kinite
Kleenkut
LoCro
Marvel (*W*)
Midvale
Ohmaloy (*Al*)
Par-exc (*W*)
Peterson
Pittsburgh Stainless
Red-Cut Superior (*V*)
Republic
Rezistal
Rockrite
Rustless
Sealmet
Sharon
Sta-Gloss
Sterling
Summerill
Superior
Thinsteel
Timken
Trentweld
U. S. S.
U. S. S. Corten

Cr-Mo

Amsco
Atlas No. 93
B & W Croloy
Bethlehem 88-80
Cecolloy
Circle L
Continental
DM-45
DM Steel
Elastuf Chro-Moly
Electrunite
[illegible] 85
Genessee
Hardtem (*V*)
Hastelloy (*WNi*)
Heppenstall 5H50 (*V*)
[illegible] (*W*)
LaSulphite
Nitralloy (*Al*)
Pressuredie No. 2
Pyrasteel (*Si*)
Sharon
Sicromo (*Mn*)

Cr-Mo-Ni

Aristoloy
Bethlehem
Continental
Cuprodie
Durodi
Elastuf
Finkl
Fivepoint
Haynes Stellite
Heppenstall 2 C 30
Hy-Ten
Illium (*Cu*)
Sandusky Alloy Iron
Sicromo (*Si*)
Summerill
Superior
Timken
Tisco
U. S. S.
Worthite

Cr-Ni

ABK Metal
Accoloy
Agaloy tubing
Allegheny Metals
Almet
Alray
Amsco
Apollo Chromsteel
Aristoloy
Armco
B & W Croloy
Bescoloy
Bethlehem
Calite
Carpenter
Chromax
Chromel
Cimet
Circle L
Continental
Cooper
Duraloy
Durco
Durimet
Elastuf
Electrunite
Enduro
ES
Evansteel
Fahralloy
Fahrite
Frankite
Genessee
Globe
Gloweld
Haynes Stellite (*W*)
[illegible]
Ingaclad
Ingersoll
Jessop
Mavari
[illegible]
Midvale
Mumetal (*Cu*)
NA, NA-1, NA-2
Ni-Hard
Page wire
Par
Pittsburgh Stainless
Pyrasteel
Rezistal
Rustless
Sharon
Silfram (*Si*)
Sta-Gloss
Standard
Sterling
Stermet
Summerill
Superior
Thermalloy
Thinsteel
Timken
Tisco
Tophet
Trentweld
U S S
Weldrawn
Zorite

Cr-Mn

Bisco
Circle L
Eis 57
Elastuf Chro-Moly
Genessee
Hascrome
Hy-Ten (*Mo*)
Inland
Lukens
Nirex
Oilway
PSI
Stoody
Timken
Tisco

Cr-V-W

Seminole

Cu

Beth-Cu-Loy
U-Loy

Mn

Amsco
Apolloy Metal (*Cu*)
Aristoloy
Bethlehem
Circle L
Hi-steel (*CuNiAl*)
Max-El
Mo-Mang
Naco
Neloy
Rol-Man
Ross-Meehan
S. G.
Strainfree Elastuf
Stressproof
Thermalized Tritex No. 2
Tisco
U. S. S. AR
U. S. S. Man-Ten

Mn-Mo

Amola
Circle L
Continental
Deward
Dodge
Jefaloy (*Si*)
Lukens
MacHempite
Max-El
Mo-Mang
Pitaloy
Ross-Meehan

Mn-Ni

Allegheny Ludlum
Amsco
Continental
Resistress (*V*)
U. S. S. Mang-Ni-Cu (*Cu*)

Mn-Si

Aristoloy
Armasteel
Bethlehem
Carpenter
Dunkirk EZ
Graph-Sil
Inland
Jefaloy
N-A-X High Tensile
Speed Case
Speed Treat
Supermal
Z-Metal

Mo

Agaloy tubing
Aldecor
Aristoloy
Bethlehem
Circle L
Economo
Genessee
Lukens
Timken
U. S. S.

Mo-Ni

Bethlehem
Circle L
Continental
Hastelloy
Republic (*Cu*)
Tigerloy

Ni

Allegheny Ludlum
Alnico (*AlCo*)
Aristoloy
Bethlehem
Carpenter
Dodge
Graph-M. N. S (*SiMoCrMn*)
Hastelloy (*SiCuAl*)
Invar (*Co*)
Kovar A (*Co*)
Lukens
Nicloy
[illegible]
Nilvar
Pittsburgh
Republic
Univan (*V*)
Yoloy (*Cu*)

Mo-Si

Graph-Mo
Silmo
Toledo Alloy

Si

Allegheny Ludlum
Armco
Durichlor
Duriron
Mosil
Silman (*Mn*)

Other Alloy Steels

Amercut
Anchor
Armco
B & W 502
Columbia
Commercial
Dodge
Duraspun
Elastuf
Falls
Graph-Tung
Intra
Keystone
Nirex
Pittsburgh
Python
Sharon
Tamco (*Ti*)

Alloy Cast Iron

Cimet
Crasfloy
Diamond
Elverite
Gunite
Hitest
Iralite
Meehanite
Ni-Hard
Ni-Resist
Ni-Tensyliron
Sandusky Alloy Iron
Shenango-Penn
Strenes C
Tamco
Tuftest

Malleable Iron

Belectric
Belectromal
Belmalloy
Ermal
Ermalite
Mallix
Perduro
Promal
Shockproof
Supermal

Special Steels (not otherwise classified)

Adamantine
Allcast
American Quality
Aristoloy
Armco
AW
AW Dynalloy
Binney Metal
Colorstrip
Cooper Alloys
Cromansite
Damascite
Dynalloy
[illegible]
Farrell's Hard Edge
Graph-Al
Jalloy
Jesson
Michigan
Min-Ox
Mo-Max
Naco
National Graphitic
National Standard
Novo
Ostuco
Otiscoloy
Pluramelt
Pompton
Premier

- PSF
- Red Anchor
- Republic
- Rex 7 Metal
- Rigidized Metal
- Rotary
- Silmanal
- Smavroc
- Standard
- Superstrip
- Supertemp
- Talon
- Ternalloy
- Thomastrip
- Timken
- Ti-Namel
- Toledo
- Trantinyl
- Vanadium
- Vasco
- Weldrawn
- Worcester Wire
- Wyckoff
- Zincgrip

Iron

- Armco
- Byers (wrought)
- Frankite
- Globeiron
- Hiperco (*Co*)
- Hipersil (*Si*)
- Odis
- Old Dominion
- Toncan Iron

ALUMINUM BASE

- Alclad
- Alcoa
- Ampcoloy
- Apex
- Auromet
- Bohnalite
- Doler Alumin
- OH-38
- Permite
- Permold
- Precision
- Red X Aluminum
- Revere
- Reynolds
- Tenual
- Trualoy
- Wellcast
- Wolverine

BEARING METALS

Babbitt

- Acorn
- Adamant
- American
- Bearite
- Bermax
- Defender Metal
- Dutch Boy
- Glacier
- Glyco
- Grapho
- Hoyt
- Johnson
- Lotus
- Lumen Alloys
- Magnolia
- Mogul
- National
- Pyramid
- Stannum
- Stonewall
- United American

Other Bearing Metals

- Agricola
- Ampco Metal
- Anfriloy
- Asarcoloy
- Bearium Metal
- Beckett Metal
- Bound Brook
- Bunting
- Cleveite
- Commercial
- Compo
- Cramp Alloys
- Durex
- Federal Bronzes
- G Alloy
- Glacier
- Gramix
- Graphalloy
- Hy-Speed
- Idealoy
- Indium
- Johnson
- Ledaloyl
- Lubrico
- Lubrik
- Lumen Alloys
- Magnolia
- Metaline
- Moccasin
- Moraine
- Mueller 600
- National
- Oilite
- Olds
- Porex
- Powdiron
- Promet
- Randall
- Sabeco
- Sandusky
- Satco
- Selflube
- Sumet
- Trualoy

BIMETALS

- Chace Thermostatic
- Dole Thermostatic
- Truflex
- Wilco Thermometal

BONDED OR PLATED

- American
- Apollo
- Armco
- Brassoid
- Bundyflex
- Chromaloid
- Colorstrip
- Copperweld
- Ingaclad
- Jessop
- Makepeace
- Nickeloid
- Paintgrip
- Platinum-Clad
- Superior
- SuVeneer
- Thomastrip
- U. S. S. Sheets
- Weiralead
- Weirzin
- Zincgrip

BISMUTH BASE

- Cerrobase
- Cerrobend
- Cerromatrix

COBALT BASE

- Delloy
- Kennametal
- Vectolite
- Vitallium

COPPER BASE

High Copper

- Ampco Metal
- Anaconda
- Bridgeport
- Elkaloy
- Elkonite
- Hussey
- Magnolia
- Mallory
- Monarch
- Moraine Porous Metal
- National
- Oldsmoloy
- Phos Copper
- Precision
- Riverside
- Sandusky
- Scovill
- Sumet
- Superior
- Trualoy
- Wolverine

Cu-Ag

- Cupaloy

Cu-Al

- Ampco Metal
- Avialite
- Frontier
- McGill
- Tempaloy (*Ni*)
- Trualoy
- Welbronco

Cu-Al-Fe

- Ampcoloy
- Ampco Metal
- Molin
- Resistac
- Resistaloy (*NiZn*)
- Revalon
- Trualoy

Cu-Be

- Anaconda
- Beraloy "A"
- Berylco No. 25
- Condaloy
- Riverside
- Viculoy

Cu-Ni

- Advance
- Ajax-Hamilton
- Ambrac
- Ampco Metal
- Anaconda
- Bridgeport
- Cartridge Brass
- Chase
- Copel
- Cunico
- Cunife
- Cupron
- Cupro Nickel
- Dairywhite
- Excelsior
- Frontier
- LMC
- Nicuite
- Phosnic
- Telnic Bronze (*PTe*)
- Ti-Nic-O-Sil
- Waukesha
- Western

Cu-Pb-Zn

- Beckett Metal
- Bridgeport
- Chase
- Redaloy
- Scovill
- Wolverine

Cu-Si

- Auromet
- Bridgeport
- Duronze
- Everdur (*Mn*)
- Herculoy (*Sn or Mn*)
- McGill
- Olympic Bronze

Cu-Sn

- Ampco Metal
- Anaconda
- Bearium Metal
- Bridgeport
- Eclipse
- Elephant Brand
- Frontier
- Harris 80-10-10 (*Pb*)
- Hy-Speed (*Pb*)
- Johnson (*Pb*) (*Sb*)
- Logan (*Pb*)
- Magnolia (*Pb*)
- Moccasin (*Pb*)
- National
- Sabeco (*Pb*)
- Western

Cu-Sn-Zn

- Admiralty
- Antimonial Admiralty (*Sb*)
- Anaconda (*Pb*)
- Bridgeport
- Chamet Bronze
- Idealoy
- Johnson
- Nicuite (*Ni*)
- Oreide
- Roman Bronze
- Scovill
- Shook (*PbNi*)
- Tobin Bronze
- Wolverine

Cu-Zn

- Aeterna 600
- Ampco Metal
- Anaconda
- Bridgeport
- D-H-S Bronze (*AlFeMn*)
- Hecla (*PbSn*)
- Hitensiloy (*PbNi*)
- Hy-ten-sil (*AlMnFe*)
- Mueller 600 Bronze
- Muntz Metal
- Revere (*Pb*)
- Tombasil (*Si*)
- Western
- Wolverine

Other Cu Alloys

- Ampcoloy
- Auromet
- Beckett Metal
- Chase Tellurium Copper
- Cupaloy (*AgCr*)
- Cuprodie
- Doler-Brass
- Elephant Brand
- Federal Bronze
- Hy-Ten-Sl Bronze
- Precision
- Riverside
- Shenango-Penn
- Sil-Fos (*AgP*)
- Summerill
- Titan
- Wolverine

ELECTRODES & WELDING RODS

- Abrasoweld
- Aerisweld
- Agile
- Agile-Actarc
- Alternex
- Aluminweld
- Ampco-Trode
- Arcos
- Borod
- Bronzochrom
- Castolin
- Cletaloy
- Coldweld
- Colmonoy
- Cromensil
- Durface
- Economy Hardface
- Farmface
- Ferroweld
- Fillex
- Fleetweld
- Genex
- Hardex
- Hardweld
- Hascrome
- Haynes Stellite
- Haystellite
- Mallory
- Manganweld
- Metal & Thermit
- Molex
- Mo Mang
- Murex
- Nickelchromeweld
- Oxweld
- Penn
- Planeweld
- Resistwear
- Shield-Arc
- Silfram
- Softweld
- Stainweld
- Stoodex
- Stoodite
- Stoody
- Titan
- To Face
- Toolweld
- Tredaloy
- Vertex
- Wearweld

LEAD BASE

- G Alloy
- Tubeloy

MAGNESIUM BASE

- Apex
- Cumberland
- Doler-Mag
- Dowmetal
- Flylight
- Hills-McCanna
- Lumen Alloys
- M-13
- Mazlo
- Permold
- Revere
- Superior
- Wellcast

MOLYBDENUM BASE

- Cleve-Tung
- Fansteel Molybdenum
- MCA Molybdenum
- Mo-Lyb-Den-Um
- Tamco

NICKEL BASE

- Adnic
- Agaloy tubing
- Allegheny Ludlum 4750
- Bundyweld (tubing)
- Chromax
- Chromel
- Conpernik
- Cooper
- Driver-Harris
- Excelsior
- Hastelloy
- Hipernik (*FeMn*)
- Hytemco
- Illium (*Cr*)
- Inconel (*Cr*)
- International
- Invar
- K-42-B (*CoFeCrTi*)
- Kovar
- Monel (*Cu*)
- Mumetal
- Nichrome
- Nilvar
- Ni-span
- Precision
- Sandusky
- Shenango Penn
- Summerill
- Thermalloy
- Tophet
- Weldrawn

PLATINUM BASE

- Baker
- Elkonium
- Nev-Oro G (*Au*)
- Paliney (*Pb*)
- Platinum-Clad
- Ready-Flow
- Wilco

POWDER METAL

- Biad
- Durex
- Fansteel
- Gempco
- Hardy Powders
- MD Metal Powders
- MRCO Metal Powder
- National
- New Jersey
- Plast-Iron
- Plast-Manganese
- Plast-Silicon
- Plast-Sponge
- Sinteel
- Stackpole
- Stressite
- Velvetouch
- Wei-Met
- Wilco

SILVER BASE

- Easy-Flo
- Elkonite
- Elkonium
- Gibsiloy
- Handy Flux
- Ready Flow
- Wilco Contact Materials

TANTALUM

- Fansteel Tantalum

TITANIUM

- Ni-Span C (*CrNi*)
- Tamco

TUNGSTEN BASE

W

- Cleve-Tungsten
- Fansteel Tungsten
- Mallory

W-Ag

- Wilco (*Pt*)

W-C

- Carboloy
- Firthaloy
- Firthite
- Kennametal
- Talide

ZINC BASE

- Apex
- Doler-Zink
- Illinois
- Nickeloid
- Precision
- Zamak
- Zilloy

ZIRCONIUM BASE

- Zirmet

Producers of Iron, Steel and Nonferrous Metals

A

Acme Aluminum Alloys Inc., 232 N. Findlay St., Dayton 3, O.
Aluminum alloys — TRIPLE-A ALMAG-35 and TRIPLE ALMAG-55
See advertisement, Page 134

Acme Steel Co., 2840 Archer Ave., Chicago 8.
Colored strip steel—COLORSTRIP and SUPERSTRIP

The Advance Foundry Co., 107 Seminary Ave., Dayton, Ohio.
Alloyed high strength cast gray iron—STRENES C

Agaloy Tubing Co., Springfield, O.
Carbon steel, alloy steel, stainless steel, Monel, Inconel, nickel and composite tubing—AGALOY Tubing

Ajax Metal Co., 46 Richmond St., Philadelphia 23.
High tensile strength alloy—TOMBASIL

The Akron Bronze & Aluminum Co., Box 1086, Akron 9, O.
Beryllium-copper sand castings—VICULOY

Allegheny Ludlum Steel Corp., Brackenridge, Pa.
Stainless steels—ALLEGHENY METALS
Special alloy tool steels—ATLAS No. 93, PYTHON and SEMINOLE
Nondeforming tool steel—DEWARD
Carbon tool steel—POMPTON
Electrical steels—ALLEGHENY LUDLUM, MUMETAL, OHMALOY and SEALMET
Mild and stainless steel—PLURAMELT
Silicon-Manganese steel—DUNKIRK EZ
See advertisement, Page 313

Alloy Casting Co., Champaign, Ill.
Chrome-iron, chrome-nickel and nickel-chrome alloys—ACCOLOY

Alloy Metal Wire Co., Moore's Station, Prospect Park, Pa.
Stainless Steels—ALMET
Electrical resistance alloy wire—ALRAY A, ALRAY C, ALRAY D, EXCELSIOR

Alloys Development Co., 1102 Park Bldg., Pittsburgh.
Low-alloy, high-tensile-strength steel—ALDECOR

Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh.
Aluminum alloys—ALCOA and ALCLAD
See advertisements, Pages 267, 271, 287

Aluminum Industries Inc., 2438 Beekman St., Cincinnati.
Aluminum base alloys—PERMITE

American Agile Corp., 5806 Hough Ave., Cleveland.
Welding electrodes—AGILE-ACTARC and AGILE

American Art Alloys Inc., 1142 South Main St., Kokomo, Ind.
Aluminum bronze alloys—MOLIN METAL

American Brake Shoe Co., Brake Shoe & Castings Div., 230 Park Ave., New York.
Ni-Cr alloy—ABK Metal and THERMALLOY

American Brass Co., Waterbury, Conn.
Copper-aluminum alloy—AVIALITE
Copper, aluminum and nickel alloy—TEMPALOY
Corrosion resistant alloys—AMBRAC, TOBIN BRONZE, ANACONDA, EVERDUR
See advertisements, Pages 297-298

American Crucible Products Co., 1301 Oberlin Ave., Lorain. O.
Bearing bronzes—PROMET

American Electro Metal Corp., 320 Yonkers Ave., Yonkers 2, N. Y.
Steel powder-metal parts—SINTEEL

American Manganese Bronze Co., Holmesburg, Philadelphia 36, Pa.
Aluminum bronzes—RESISTAC
Aluminum-manganese bronzes—HY-TEN-SL
See advertisement, Page 314

American Manganese Steel Div., The American Brake Shoe Co., Chicago Heights, Ill.
Cast alloy steels and welding rods—AMSCO
Welding rod—MO-MANG

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
Magnesium alloys—MAZLO
See advertisement, Page 145

American Nickeloid Co., 23 Second St., Peru, Ill.
Prefinished bonded-sheet and strip—NICKELOID, CHROMALOID, BRASSOID; AMERICAN Bonded Metals, and Copper Steel

American Platinum Works, The, Newark, N. J.
Silver Brazing Alloys—READY FLOW

American Rolling Mill Co., Middletown, O.
Stainless and high strength steels—ARMCO
Galvanized sheet iron or steel—ZINCGRIP and PAINTGRIP
Medium silicon electrical steels—TRAN-COR

American Smelting & Refining Co., Equitable Bldg., New York.
Cadmium-nickel bearing alloy—ASARCOLOY No. 7
Lead-bearing alloy—"G" ALLOY
Tubing—TUBELOY

American Steel & Wire Co., Rockefeller Bldg., Cleveland.
Carbon steels and alloys—AMERICAN QUALITY
Cold-finished steel bars—AMERCUT
Spring steel—PREMIER

Ampco Metal Inc., 1745 South 38th St., Milwaukee 4.
Corrosion, shock and wear-resistant alloys—AMPCO METAL
Coated welding rods—AMPCO-TRODE
Copper-base alloys—AMPCOLOY
See advertisement, Page 288

Amplex Mfg. Co., Div of Chrysler Corp., P. O. Box 2718 Harper Ave., Detroit 31.
(See Chrysler Corp.)

Anchor Drawn Steel Co., Latrobe, Pa.
High-carbon steel—RED ANCHOR, BLUE ANCHOR, GOLD ANCHOR, ANCHOR Carbon-Vanadium, and VASCO

Apex Smelting Co., 2537 W. Taylor St., Chicago 12.
Aluminum, zinc and magnesium alloys—APEX

Apollo Metal Works, 6605 South Oak Park Ave., Chicago 38.
Prefinished cold-rolled steel, and zinc-steel—APOLLO

Apollo Steel Co., Apollo, Pa.
Copper-bearing steel—APOLLOY METAL

Arcos Corp., Philadelphia 2, Pa.
Arc Welding Electrodes—ARCOS

Athenia Steel Co., Div. of National Standard Co., Clifton, N. J.
High-carbon steels—ATHENIA Steel
See advertisement, Page 138

Aurora Metal Co., 614 West Park Ave., Aurora, Ill.
Aluminum-bronze alloy—AUROMET

Austenal Laboratories Inc., N. Y. C. and Chicago.
Precision-casting high-strength alloy—VITALLIUM
See advertisement, Page 307

B

Babcock & Wilcox Co., 85 Liberty St., New York 6
Corrosion, wear and heat-resisting alloys—ADAMANTINE, ELVERITE and B&W 5202

Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Corrosion and heat-resisting seamless and welded steel tubes—B & W CROLOY, NICLOY
Nickel-steel seamless tubing—NICLOY
See advertisement, Page 265

Baker & Co. Inc., 113 Astor St., Newark 5, N. J.
Platinum, palladium, gold, silver and their alloys—BAKER and PLATINUM-CLAD

Bearium Metals Corp., 268 State St., Rochester, N. Y.
Bearing bronzes—BEARIUM METAL
See advertisement, Page 316

Belle City Malleable Iron Co., Racine, Wis.
Pearlitic malleable iron—BELMALLOY
High-strength malleable iron—BELECTROMAL
Electric-furnace-melted cast iron—BELECTRIC

Beryllium Corp. of Penna., Reading, Penna.
Beryllium-coppers—BERYLCO No. 10, 25 and 70

Bethlehem Steel Co., Bethlehem, Pa.
Copper-bearing steel—BETH-CU-LOY
High-carbon, manganese and nickel steels; and chromium-molybdenum steel castings—BETHLEHEM
High-temperature alloy steel—SUPERTEMP
Nickel-chromium steels—MAYARI
High-carbon chromium steel—ABRASIST
See advertisement, Page 274

Biad Powder Metallurgy Co., Pittsburgh 6.
Powder Metals—BIAD

Binney Castings Co., 2555 Dorr St., Toledo 7, O.
Heat-resisting castings—MIN-OX, BINNEY METAL and BINNEY NO. 71 and NO 73.

Bliss & Laughlin Inc., P. O. Box 945, Buffalo, N. Y.
High-sulphur bessemer screw stock—ULTRACUT
See advertisement, Page 314

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit.
Light-aluminum alloy—BOHNALITE
See advertisement, Page 163

H. Boker & Co. Inc., 101 Duane St., N. Y. 7.
Tool steel—INTRA, KINITE
Die steel—OILWAY
High-speed steel—NOVO SUPERIOR

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.
Bearing bronzes—BOUND BROOK and COMPO
Porous iron bearing alloys—POWDIRON
See advertisement, Page 284

Braeburn Alloy Steel Corp., Braeburn, Pa.
High abrasion and high tensile strength alloys—PRESSUREDIE No. 2 and SUPERIOR No. 3

Bridgeport Brass Co., Bridgeport, Conn.
High-copper silicon bronzes—DURONZE
Copper and zinc alloys—BRIDGEPORT
Tubing—BRIDGEPORT

Brighton Electric Steel Casting Co., Beaver Falls, Pa.
Alloy cast steel—BESCOLOY

The Brush Beryllium Co., 3714 Chester Ave., Cleveland 14, O.
Beryllium coppers—CONDULOY and NO. 6

Buckeye Brass & Mfg. Co., 6410 Hawthorne, Cleveland.
Bearing bronzes—COMMERCIAL, HYSPEED and LUBRICO

Buffalo Wire Works Co. Inc., 430 Terrace, Buffalo.
Wire cloth—BUFFALO

Bundy Tubing Co., 8109 E. Jefferson, Detroit.
Steel, Monel, "A" and "L" Nickel tubing—BUNDYWELD
See advertisement, Page 140

Bunting Brass & Bronze Co., Spencer and Carlton Sts., Toledo, O.
Bearing bronzes—BUNTING

Burgess-Parr Co., Freeport, Ill.
Acid-resisting alloy—ILLIUM G

Byers Co., A. M., Clark Bldg., Pittsburgh 30.
Wrought iron—BYERS

C, D

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh.
Nickel-bronze alloy—NICUITE
Babbitt metal—BEARITE and ACORN
Copper alloy—CUPALOY

Calorizing Co., 400 Hill Ave., Wilkinsburg, Pittsburgh, Pa.
Heat-resisting cast steels—CALITE

Cambridge Wire Cloth Co., Inc., 940 Washington Blvd., Cambridge, Md.
Wire Cloth—CAMBRIDGE
See advertisement, Page 275

Carboloy Co. Inc., 11177 East 8-Mile Rd., Detroit.
Powder metals—CARBOLOY
See advertisement, Page 278

Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh.
Abrasion-resisting steels—U.S.S. AR STEEL
Alloy steels—U.S.S. CARILLOY
High strength steels—U.S.S. CORTEN, U.S.S. MANG-NI-CU steels and U.S.S. MAN-TEN
Stainless steels—U.S.S. STAINLESS
Sheet steels—U.S.S.
See advertisement, Page 157

Carpenter Steel Co., Reading, Pa.
Stainless and specialty alloy steels—CARPENTER
Low expansion alloys—INVAR
See advertisements, Pages 154-155, 286

Cerro de Pasco Copper Corp., 40 Wall St., New York.
Bismuth-lead-tin-antimony castings—CERROMATRIX, CERROBASE and CERROBEND

Chace Co., W. M., 1614 Beard Ave., Detroit 9.
Thermostatic bimetals, and manganese alloys—CHACE

Chain Belt Co., 1604 W. Bruce St., Milwaukee 4.
High-tensile, corrosion-resistant castings—REX Z METAL

Chase Brass & Copper Co., Waterbury 91, Conn.
Corrosion-resistant copper alloys—OLYMPIC BRONZE, ANTIMONIAL ADMIRALTY, CHAMET BRONZE, CHASE TELLURIUM COPPER, CHASE and PHOSNIC BRONZE
High tensile strength bronze—TELNIC Bronze
Tellurium aluminum bronze—CHASE

Chicago Steel Foundry Co., Kedzie Ave. and 37th St., Chicago.
High tensile strength castings—EVANSTEEL and PYRASTEEL

Chrysler Corp., Amplex Div., P. O. Box 2718, Detroit 31.
Bearing bronze—OILITE
Bearing iron alloy—SUPER-OILITE
Bearing iron—IRON OILITE
Bearing iron alloy hardened—SUPER-OILITE 16
Bearing aluminum—ALUMINUM OILITE
Nonporous, high-density material—DAMASCITE and STRESSITE

Cleveland Graphite Bronze Co., 16800 St. Clair Ave., Cleveland.
Copper-lead strip and bushings—CLEVITE

Cleveland Tungsten Inc., 10200 Meech Ave., Cleveland.
Copper-tungsten electrodes—CLETALOY
Tungsten ground seal rod—CLEVE-TUNGSTEN
Molybdenum bars, wire, sheet, plate and powder metal—CLEVE-TUNG

Cleveland Twist Drill Co., The, 1242 East 49th St., Cleveland 14.
High-speed steel—MO-MAX
See advertisement, Page 315

Climax Molybdenum Co., 500 Fifth Ave., New York 18.
Molybdenum alloying element—MO-LYB-DEN-UM
See advertisement, Page 257

Cold Metal Products Co., The, Youngstown, O.
Carbon, alloy and stainless strip steel—THINSTEEL
See advertisement, Page 285

Columbia Steel & Shafting Co., Woodkrik St., Pittsburgh 30.
High-tensile steel—COLUMBIA

Commercial Steel Castings Co., 1205 Cheney Ave., Marion, O.
Steel castings to specification—COMMERCIAL

Continental Foundry & Machine Co., East Chicago, Ind.
Iron alloys—CROMONITE and CRASFLOY
Carbon steels and alloy steels for rolls—CONTINENTAL

Cooper Alloy Foundry Co., 200 Bloy St., Hillside, N. J.
Alloy castings—COOPER ALLOYS

Columbia Steel & Shafting Co., Woodkirk St.,
Alloy steels—ARISTOLOY
Copper-covered steel—COPPERWELD

Cramp Brass & Iron Foundries Div. Baldwin Locomotive Works, Philadelphia.
Copper alloys—CRAMP ALLOYS

Crucible Steel Casting Co., Almira Ave., and W. 84th St., Cleveland.
Sand castings—PAR

Crucible Steel Co. of America, 405 Lexington Ave., New York.
High-strength alloy steel—MAXEL
Corrosion and heat-resistant alloys—LO CRO and REZISTAL

Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Turned and ground steel—CUMBERLAND

Delloy Metals, 3rd & Huntington Sts., Philadelphia 33.
Chromium-cobalt-tungsten alloys—DELLOY METALS

Dodge Steel Co., Tacony, Philadelphia 35.
Electric steel castings—DODGE

Doehler Jarvis Corp., 386 Fourth Ave., New York 16.
Copper-zinc-silicon alloys—DOLER-BRASS and DOLER-ZINK
Magnesium base alloys—DOLER-MAG
Aluminum base die castings—DOLER-ALUMIN

Dow Chemical Co., Midland, Mich.
Magnesium and magnesium alloys—DOWMETAL

Driver Co., Wilbur B., Riverside Ave., Newark, N. J.
Beryllium-copper alloys—BERALOY "A", CUPRON and TOPHET

Driver-Harris Co., Harrison, N. J.
Corrosion, heat and wear resisting alloys—ADVANCE, NIREX, NILVAR, CHROMAX, CIMET, NICHROME, HYTEMCO, DRIVER-HARRIS 42 and 52 ALLOYS

Duraloy Co., Scottsdale, Pa.
Centrifugal corrosion-resistant castings—DURASPUN
Corrosion and heat-resistant cast tubing—DURALOY C. N and 18-8

Duriron Co. Inc., Dayton, O. (and licensees—see Duriron in tradename listing).
Corrosion and heat-resistant alloy castings—DURICHLOR, DURIMET, DURIRON and DURCO

E, F

Eastern Stainless Steel Corp., Baltimore 3, Md.
Stainless steel sheet—ES

Electro-Alloys Co., Elyria, O.
Nickel-chromium—THERMALLOY

Electro Metallurgical Sales Corp., 30 East 42nd St., New York 17.
Ferro-alloys and alloying elements—ELECTROMET
See advertisement, Page 139

Erie Malleable Iron Co., Erie, Pa.
Abrasion and wear-resisting cast products—ERMAL and ERMALITE

Eutectic Welding Alloys Co., 40 Worth St., New York 13.
Welding alloys—CASTOLIN, COLDWELD, BRONZOCHROM and DURFACE.

Everhot Products Co., 2055 W. Carroll Ave., Chicago 12.
Copper-fused steel tubing—BUNDYFLEX Tubing

Fahralloy Co., Harvey, Ill.
High nickel-chrome—FAHRALLOY

Falls Hollow Staybolt Co., 7 E. Portage Trail, Cuyahoga Falls, O.
Wrought iron—FALLS

Fansteel Metallurgical Corp., North Chicago, Ill.
Corrosion-resistant, high-tensile-strength metals—FANSTEEL

Farrell-Cheek Steel Co., Sandusky, O.
Abrasion-resisting cast steel—FARRELL

Federal Mogul Corp., 11031 Shoemaker Ave., Detroit.
Bearing bronzes—FEDERAL BRONZES
Babbitt bearing alloys—MOGUL BABBITTS
Lead base babbitt—BERMAX BABBITT
See advertisement, Page 299

Ferrous Metals Corp., 36 W. 44th St., New York 18.
Abrasion resistant alloy—Z METAL

Finkl & Sons Co., A., 2011 Southport Ave., Chicago.
Heat resistant alloys—DURODI and CUPRODIE
Carbon-chrome-nickel-molybdenum alloys—FINKL

Firth-Sterling Steel Co., McKeesport, Pa.
Sintered carbides—FIRTHITE and FIRTHALOY
Stainless steels, and chrome-nickels—STERLING

METALS PRODUCERS

Foote Bros. Gear and Machine Corp., 5225 S. Western Blvd., Chicago.
Nickel-molybdenum alloy — FIVEPOINT DEEPHARD STEEL

Foote Mineral Co. Inc., 10 E. Chelten Ave., Philadelphia 44.
Ductile zirconium metal—ZIRMET

Fort Howard Steel & Wire Div., Research Parts & Engineering Corp., State and Ninth Sts., Green Bay, Wis.
Round bars and wire—FORT HOWARD

Frank Foundries Corp., Moline, Ill.
Corrosion and abrasion-resistant alloys — FRANKITE

Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
Heat and wear-resisting alloys—FRONTIER

G, H, I

General Electric Co., Schenectady, N. Y. (and licensees—see Alnico in tradename listing).
Magnet alloy—ALNICO, SILMANAL, VECTOLITE, CUNIFE and CUNICO
Welding electrodes—TRODALOY

General Metals Powder Co., Akron, O.
Metallic friction materials—Gempco

General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Thermostat metals—TRUFLEX

Gibson Electric Co., 8350 Frankstown Ave., Pittsburgh 21.
Electrical contact materials—GIBSILOY
See advertisement, Page 304

Glacier Metal Co., Richmond, Va.
Bearing babbitt—GLACIER

Globe Steel Tubes Co., Milwaukee.
Seamless steel tubing—GLOBE
High purity ingot iron—GLOBEIRON
Stainless welded tubing—GLOWELD
See advertisement, Page 261

Graphite Metallizing Corp., 1050 Nepperhan Ave., Yonkers 3, N. Y.
Carbon-graphited metallized material — GRAPHALLOY

Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit, Mich.
High-tensile, low alloy steels—N-A-X

Gunite Foundries Corp., 302 Peoples Ave., Rockford, Ill.
Processed cast irons, cast steels—GUNITE

Handy & Harman, 82 Fulton St., New York 7.
Brazing alloys—HANDY FLUX, SILFOS, and EASY-FLO

Hardy Inc., Charles, 420 Lexington Ave., New York 17.
Powdered metal—HARDY Metal Powders

Harris & Co., Arthur, 212 N. Aberdeen St., Chicago 7.
Copper-nickel alloy—DAIRYWHITE
Bearing metal—HARRIS 80-10-10

Haynes Stellite Co., Kokomo, Ind.
Heat, corrosion and abrasion-resistant cobalt-chromium-tungsten—HAYNES STELLITE
Abrasion-resistant tungsten-carbide diamond substitute—HAYSTELLITE
Impact-resistant, iron-base, hard-facing rod—HASCROME
Nickel-base alloys—HASTELLOY
See advertisement, Page 141

Hedstrom Corp., Oscar W., 4836 W. Division St., Chicago.
Aluminum alloy—OH-38.

Heppenstall Co., Hatfield St., Pittsburgh.
Abrasion-resistant alloy steels—HARDTEM and KLEENKUT
High-strength alloy steel—HEPPENSTALL and EIS-45.
Nickel-chrome-molybdenum steel—EIS-57

Hills-McCanna Co., 2349 Nelson St., Chicago.
Magnesium alloy sand castings—HILLS-MC-CANNA

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit.
Heating element alloys—CHROMEL and COPEL

Howard Foundry Co., Magnesium Div., Chicago.
High tensile strength alloy—FLYLITE

Hussey & Co., C. G., Div. of Copper Range Co., 2850 Second Ave., Pittsburgh.
Copper sheet—HUSSEY

Illinois Zinc Co., 2959 W. 47th St., Chicago 32.
Sheet and strip zinc—ILLINOIS

Indium Corp. of America, 1676 Lincoln Ave., Utica, N. Y.
Lead-silver solder—INDIUM

Ingersoll Steel & Disc Division, Borg-Warner Corp., 310 S. Michigan Ave., Chicago.
Stainless-clad steel—INGACLAD
Stainless steel—INGERSOLL

Inland Steel Co., 38 S. Dearborn St., Chicago 3.
Low-carbon alloy steel—TI-NAMEL
Corrosion resistant steel—HI-STEEL
Carbon steels, etc.—INLAND Steels

International Nickel Co. Inc., 67 Wall St., New York (and licensees).
Corrosion, heat and wear-resisting alloys—NI-TENSYLIRON, NI-HARD, NI-RESIST, NI-SPAN, INTERNATIONAL, NICKEL, MONEL and INCONEL
See advertisement, Page 143

J, K, L

Jeffrey Mfg. Co., The, First Ave. and Big Four railroad, Columbus 16, O.
High-strength malleable irons—PERDURO, SUPERMAL and JEFALOY

Jessop Steel Co., Washington, Pa.
Nonmagnetic and stainless steels—JESSOP
Stainless steels—DURO-GLOSS, HI-GLOSS and STA-GLOSS

Johnson Bronze Co., New Castle, Pa.
Bearing metals—JOHNSON, LEDALOYL
See advertisement, Page 251

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh.
Free-machining steel—JALCASE
High-impact special steel—JALLOY
High-tensile, lightweight steel—OTISCOLOY
Cold-finished steel, cold-drawn shapes and tubing—J & L STEELS
See advertisement, Page 253

Kennametal Inc., 1 Lloyd Ave., Latrobe, Pa.
Carbide alloys—KENNAMETAL
See advertisement, Page 290

Keystone Carbon Co., Saint Marys, Pa.
Self-lubricating porous bronze—SELFLUBE

Keystone Drawn Steel Co., Spring City, Pa.
Standard analyses cold-finished steels—KEYSTONE

Koppers Co., Inc., Bartlett-Hayward Div., Baltimore.
Bronze alloy—D-H-S BRONZE

Lake City Malleable Co., 5060 Lakeside Ave., Cleveland.
Malleable iron—SHOCKPROOF
See advertisement, Page 320

La Salle Steel Co., 150th and Magnolia, Hammond, Ind.
High-tensile alloy—STRESSPROOF, LA SULPHITE 8640 and THERMALIZED TRITEX No. 2

Lebanon Steel Foundry, Lebanon, Pa.
Alloy cast steels—CIRCLE L
See advertisement, Page 294

Lehigh Babbitt Co., Box 1004, Allentown, Pa.
Babbitt metal—GRAPHO

Lewin-Mathes Co., 1111 Chouteau Ave., St. Louis 2.
Copper and copper alloys—LMC

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
High tensile welding rods—SHIELDARC, MANGANWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, FERROWELD, ALUMINWELD.

Linde Air Products Co., The, 30 E. 42nd St., New York.
Welding rods—OXWELD
See advertisement, Page 153

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6.
Malleable cast iron—PROMAL

Lukens Steel Co., Coatesville, Pa.
Various types of steels—LUKENS

Lumen Bearing Co., 197 Lathrop Ave., Buffalo.
Bearing alloys—LUMEN ALLOYS

M

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh.
Cast iron—IRALITE
High tensile strength metal—MacHEMPITE

Magnolia Metal Co., 18 W. Jersey St., Elizabeth 4, N. J.
Babbitt metal—ADAMANT Super-Genuine Babbitt and MAGNOLIA Power Nickel-Genuine Babbitt
Antifriction metal—MAGNOLIA, DEFENDER and PYRAMID

Magnus Metal Corp., 80 Jackson Blvd., Chicago. (also 111 Broadway, New York)
Lead base alloy—SATCO Bearing Metal

Makepeace Co., D. E., Attleboro, Mass.
Laminated precious metals—MAKEPEACE
See advertisement, Page 302

Mallory, P. R., & Co. Inc., Indianapolis.
Welding electrodes—ELKALOY and ELKONITE
Copper base alloys—MALLORY
Electrical contacts—ELKONIUM and ELKONITE

Manganese Steel Forge Co., Allen St. and Butler Ave., Philadelphia.
Forged alloy steel—ROL-MAN

Massillon Steel Castings Co., Massillon, O.
Alloy cast steel—TIGERLOY
Nitriding steel—NITRALLOY

McGill Mfg. Co., Valparaiso, Ind.
Corrosion-resistant alloys—McGILL

Medart Co., 3500 DeKalb St., St. Louis.
High tensile strength cast iron—HITEST
Abrasion-resistant cast iron—TUFTEST
Alloy steel forgings—SMAVROC

Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y. (and foundries—see Meehanite in tradename listing)
Wear, heat and corrosion-resistant metals—MEEHANITE
See advertisement, Page 319

Metal Carbides Corp., Youngstown, O.
Tungsten-carbide metal—TALIDE

Metal Hose Div., Bendix Aviation Corp., Teterboro, N. J.
Seamless flexible metal hose—ECLIPSE and BENDIX

Metal & Thermit Corp., 120 Broadway, New York.
Arc welding electrodes—ALTERNEX, CROMANSIL, FILLEX, GENEX, HARDEX, MOLEX, VERTEX and METAL & THERMIT

Metals Disintegrating Co. Inc., Elizabeth, N. J.
Powder metal—MD Metal Powders

Metals Refining Co., Hammond, Ind.
Powder metal—MRCO METAL POWDER

Michiana Products Corp., P. O. Box 302, Michigan City, Ind.
Heat and corrosion resisting castings—ZORITE

Michigan Seamless Tube Co., South Lyon, Mich.
Seamless tubing—MICHIGAN

Midvale Co., The, Nicetown, Philadelphia 40.
Heat and corrosion resisting steels—MIDVALE

Moccasin Bushing Co., 20th and Chestnut Sts., Chattanooga, Tenn.
Bronze alloys—MOCCASIN

Molybdenum Corp. of America, Grant Bldg., Pittsburgh.
Alloying elements—MCA Molybdenum and MCA Ferro-Boron

Monarch Alloys Co., Ravenna, O.
High-lead bronzes—MONARCH

Monarch Steel Co., Indianapolis, (also affiliated company, W. J. Holliday & Co., Hammond, Ind.)
Low-carbon free-machining open-hearth steel—SPEED CASE
Medium-carbon, free-machining open-hearth steel—SPEED TREAT

Moraine Products Div., General Motors Corp., 1420 Wisconsin Blvd., Dayton, O.
Bearing alloys—DUREX and MORAINE
Powdered metal—MORAINE POROUS METAL
See advertisement, Page 151

Mueller Brass Co., Port Huron, Mich.
Bearing alloy—MUELLER 600 Bearing Metal
Brass base alloy—AETERNA 600 Alloy

N, O

National Alloy Steel Division, Blawnox, Pa.
Corrosion-resisting castings — NA, NA-1, NA-2

National Bearing Div., American Brake Shoe Co., 430 Manchester St., St. Louis 10.
Nonferrous centrifugal and precision castings, etc.—NATIONAL METALS

National Bronze & Aluminum Foundry Co., E. 93d and Laisy Ave., Cleveland.
Aluminum castings—TENUAL

National Erie Corp., Erie, Pa.
Steel castings—NELOY

National Lead Co., 111 Broadway, New York 6.
Babbitt metal—DUTCH BOY BABBITT and HOYT BABBITT

National Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland.
Alloy cast steel—NACO
Malleable cast iron—MALLIX
Chromium-manganese-carbon alloy—NUREX
High-strength steel—NATIONAL Graphitic Steel

National Molded Products Inc., 122 Mill St., St. Marys, Pa.
Powder metal—NATIONAL

National Smelting Co., P. O. Box 1791, Cleveland 5.
Aluminum alloys—RED X, TERNALLOY and ALLCAST

National Standard Co., Niles, Mich.
Wires, braided wire and tapes—NATIONAL-STANDARD
See advertisement, Page 138

New Jersey Zinc Co., 160 Front St., New York.
Zinc alloy—ZAMAK and ZILLOY
Brass and Spherical Powders—NEW JERSEY ZINC
See advertisement, Page 166

Ney Co., The J. M., 71 Elm St., Hartford, Conn.
Corrosion-resistant alloys — PALINEY and NEY-ORO G

Nitralloy Corp., The, 230 Park Ave., New York
(licensees—see Nitralloy in tradename listing.)
Nitriding steel—NITRALLOY

Ohio Ferro Alloys Corp., Canton, O.
Ferro alloys—PHILO and RANIER

Ohio Seamless Tube Co., Shelby, O.
Precision tubing—OSTUCO
See advertisement, Page 258

Ohio Steel Foundry Co., The, Lima, O.
Corrosion-heat-resistant materials—FAHRITE

Old Dominion Iron & Steel Corp., Belle Isle, Richmond 3, Va.
Staybolt wrought iron—ODIS and OLD DOMINION Iron

Olds Alloys Co., 441 Mason St., South Gate, Calif.
Bearing bronze—OLDS Bearing Bronze
Chromium-molybdenum bronze — OLDSMOLOY

P

Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa.
Low and high-carbon wire—PAGE

Penacolite Div., Pennsylvania Coal Products Div., Petrolia, Pa.
Adhesive—PENACOLITE

Permold Co., Medina, O.
Permanent mold and sand castings—PERMOLD

Penn Brass & Copper Co., Erie, Pa.
Seamless brass and copper tubing—SUPERIOR

Peterson Steel—Peterson Steels Inc., 420 Lexington Ave., New York 17.
High abrasion resistance steels—PETERSON STEELS and PSI

Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51.
Carbon steels—GRAPHITSTEEL
Iron cast alloy—DIAMOND ALLOY

Phosphor Bronze Smelting Co., 2200 Washington Ave., Philadelphia 46.
Phosphor bronze—ELEPHANT BRAND
See advertisement, Page 312

Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh 1.
Bearing bronze—LUBRIK
Stainless steels—PITTSBURGH Alloy and Stainless Steels

Pittsburgh Steel Co., Grant Bldg., Pittsburgh 30.
Carbon and alloy steels—PITTSBURGH Steels

Pittsburgh Steel Foundry Corp., Glassport, Pa.
Manganese-molybdenum alloy — PITALOY and PSF

Plastic Metals Div., The National Radiator Co., 177 Bridge St., Johnstown, Pa.
Powder metals — PLAST-IRON, PLAST-MANGANESE, PLAST-SILICON and PLAST-SPONGE

Potts Co., Horace T., E. Erie Ave., and D St., Philadelphia 34.
Chrome-nickel-molybdenum alloy — ELASTUF CHRO-MOLY
Cold-finished and hot-rolled steels—ELASTUF PENN
Hot-rolled and precision finish machinery steels—ELASTUF MEDIA
Alloy machinery steels—ELASTUF

Precision Castings Co., Inc., Syracuse, New York.
Aluminum and zinc base alloys—PRECISION
Magnesium die castings—M-13

Precision Tube Co., 3824 Terrace St., Philadelphia.
Seamless tubing, and metal-shielded wire—PRECISION

R, S

Randall Graphite Products Corp., 609 W. Lake St., Chicago.
Graphite bronze bearings and bushings — RANDALL

Reliance Steel Casting Co., 2818 Smallman St., Pittsburgh.
Manganese-nickel-vanadium alloy steel—RESISTRESS

Republic Steel Corp., Republic Bldg., Cleveland.
Open-hearth iron alloy—TONCAN IRON
Copper-bearing steel—U-LOY
Low-carbon high-strength steel—COR-TEN (See under U.S.S. COR-TEN) and ALDECOR
Low-carbon double-strength steel—REPUBLIC

Republic Steel Corp., Alloy Steel Div., Massillon, O.
Stainless and heat-resisting alloys—ENDURO

Steel & Tube Division, Republic Steel Corp., and 224 East 131st St., Cleveland 8.
Steel and forrous alloy tubing—ELECTRUNITE

Revere Copper & Brass Inc., 230 Park Ave., New York 17.
Nonmagnetic corrosion-resistant, silicon bronze—HERCULOY
Bearing bronze—ROMAN BRONZE
Condenser tubes and plates, REVALON and CUPRO-NICKEL, 30 per cent
Magnesium and aluminum alloys—REVERE
Free-cutting brass—REVERE
High corrosion-resistant brass—MUNTZ Metal
High tensile strength brasses—CARTRIDGE Brass and ADMIRALTY Metal
See advertisements, Pages 263-264

Reynolds Metals Co. Inc., P. O. Box 1800, Louisville 1, Ky.
Wrought aluminum alloys—REYNOLDS
See advertisements, Pages 282-283

Rhoades, R. W., Metaline Co. Inc., P. O. Box No. 1, Long Island City, N. Y.
Heat-resisting bearing bronze—METALINE

Rigid-Tex Corp., 658 Ohio, Buffalo 3, N. Y.
Ferrous or nonferrous alloys—RIGIDIZED Metal

Riverside Metal Co., Riverside, N. J.
Phosphor bronze, nickel silver and beryllium copper—RIVERSIDE
See advertisement, Page 301

Ross-Meehan Foundries, 1601 Carter St., Chattanooga, Tenn.
Manganese cast steels—ROSS-MEEHAN

Rotary Electric Steel Co., Box 90, Ferndale Sta., Detroit.
Standard SAE grades of alloy steels—ROTARY

Rustless Iron & Steel Div., The American Rolling Mill Co., 3400 East Chase St., Baltimore 13.
Stainless steels—RUSTLESS
See advertisement, Page 305

Ryerson Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago.
Specially processed lead base alloys—GLYCO BABBITT
Standard steels—RYERSON
See advertisement, Page 310

Saginaw Bearing Co., Saginaw, Mich.
Bearing bronzes—SABECO and AGRICOLA
See advertisement, Page 132

Saginaw Malleable Iron Div., Saginaw, Mich.
Castings—ARMSTEEL

Sandusky Foundry & Machine Co., Sandusky, O.
Bronze, brass, manganese bronze and Monel SANDUSKY
See advertisement, Page 306

Scovill Mfg. Co., Waterbury, Conn.
Standard high and low brasses, phosphor-bronzes, nickel-silvers, cupro-nickels, etc. —SCOVILL and ADNIC
Spring material—OREIDE
See advertisement, Page 295

Sharon Steel Co., Sharon, Pa.
Standard carbon, alloy and stainless steels —SHARON

Shenango-Penn Mold Co., Dover, O.
High-strength alloys—SHENANGO-PENN

Shook Bronze Corp., Lima, O.
Bearing bronze—SHOOK Alloy 664

Stackpole Carbon Co., St. Marys, Pa.
Powder metals—STACKPOLE
See advertisement, Page 277

Standard Tube Co., 14600 Woodward Ave., Detroit 3.
Carbon and stainless steel tubing—STANDARD Tubing
See advertisement, Page 293

Sterling Alloys Inc., Woburn, Boston, Mass.
Standard stainless steel castings—STERMET

Stoody Co., Whittier, Calif.
Hard-facing welding rods — SILFRAM, STOODEX, STOODY, STOODITE, BOROD and STOODY TUBE BORIUM

Sumet Corp., 1543 Filmore Ave., Buffalo.
Bronze bearings—SUMET

Summerill Tubing Co., Bridgeport, Montgomery Co., Pa.
Seamless tubing—SUMMERILL

Superior Bearing Bronze Co., 139 Banker St., Brooklyn.
Magnesium castings—SUPERIOR

Superior Metal Co., Clearing Station, Chicago 38.
Copper-plated strip steel—SUPERIOR Coppor Steel

Superior Metal Works, 66th Place at South Oak Park, Chicago 38.
Prefinished strip steel—SUPERIOR

Superior Steel Corp., Carnegie, Pa.
Stainless strip steel—SUPERIOR Stainless
Steel clad metal—SUVENEER
See advertisement, Page 165

Superior Tube Co., Norristown, Pa.
Welded tubing—WELDDRAWN

Symington-Gould Corp., Rochester, N. Y.
Structural alloys, corrosion, heat and abrasion-resistant alloys—GENESSEE
Cast carbon steels—S.G.

T

Taylor-Wharton Iron and Steel Co., High Bridge, N. J.
Manganese, manganese-nickel and magnet metals—TISCO

Thomas Steel Co., Warren, O.
Cold-rolled strip steel—THOMASTRIP

Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Abrasion-resistant bearing alloys—GRAPHSIL, GRAPH-MO, GRAPH-M.N.S., GRAPH-AL, and GRAPH-TUNG
Creep-resisting alloy steels—DM STEEL, DM-45, SICROMO STEEL
Corrosion and heat-resistant alloys—SILMO, TIMKEN
See advertisement, Page 273

Titan Metal Mfg. Co., Bellefonte, Pa.
Welding rods—TITAN and PENN
Corrosion-resistant rods—TITAN
Forging brass—LOGAN and REDALOY No. 1
Forging bronze—HECLA, HITENSILOY and RESISTALOY
Nickel-silver forging alloy—TI-NIC-O-SIL

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Extra low carbon trimming steel—TAMCO

Trent Tube Mfg. Co., East Troy, Wis.
Stainless tubing—TRENTWELD

True Alloys Inc., 284 S. Summit, Detroit.
Aluminum-bronze alloys—TRUALOY

Tube Reducing Corp., 520 Main Ave., Wallington, N. J.
Seamless tubing—ROCKRITE Seamless Tubing

Tyler, W. S., Co., 3615 Superior Ave., Cleveland.
Abrasion-resisting material—TY-LOY

U, V, W

Union Steel Casting Division, Blaw Knox Co., 62nd and Butler Sts., Pittsburgh.
Nickel-vanadium steel—UNIVAN

Unitcast Corp., Steel Casting Div., Toledo, O.
Alloy and carbon electric steel castings—TOLEDO ALLOY
See advertisement, Page 281

United American Metals Corp., 200 Diamond St., Brooklyn 22, N. Y.
Babbitt metals—STONEWALL Babbitt, AMERICAN Marine Genuine Babbitt and UNITED AMERICAN Babbitts

United States Graphite Co., Saginaw, Mich.
Porous Metal—GRAMIX
See advertisements, Pages 147, 160-161

United States Steel Corp., 436 Seventh Ave., Pittsburgh.
(See also American Steel & Wire Co., and Carnegie-Illinois Steel Corp.)
Stainless steels, Shelby and National tubing, castings, electrical steel sheets, copper steel sheets—USS
High strength steels—USS CORTEN, USS MANG-NI-CU Steel and USS MAN-TEN
Alloy steels—USS CARILLOY
Abrasion-resistant steels—USS AR STEEL
See advertisement, Page 133

Vanadium Alloys Steel Co., Latrobe, Pa.
High heat resistant alloys—RED-CUT SUPERIOR, MARVEL and HOTFORM
High tensile strength alloys—NIKRO M, SILMAN, MOSIL, PAR-EXC, COLONIAL and VANADIUM

Wall-Colmonoy Corp., 720 Fisher Bldg., Detroit.
Hard-facing welding rods—COLMONOY

Washington Steel Corp., Washington, Pa.
Standard stainless steels—MICROROID

Waukesha Foundry Co., Waukesha, Wis.
Copper-base high-nickel alloys—WAUKESHA Metals

Weirton Steel Co., Weirton, W. Va.
Zinc-coated sheets—WEIRZIN
Ductile sheets—WEIRALEAD

Wellman Bronze & Aluminum Co., 6017 Superior Ave., Cleveland.
Copper-tin-zinc-lead alloys—IDEALOY and ANFRILOY
Aluminum-silicon-titanium alloy — WELLCAST
Copper-base, aluminum and magnesium sand castings—WELLCAST and WELBRONCO

Wellman, S. K., Co., The, 1374 E. 51st St., Cleveland.
Friction material—VELVETOUCH

Wel-Met Co., 110 Gougler Ave., Kent, O.
Sintered bronze and iron—WEL-MET

Western Brass Mills, Div. of Olin Industries Inc., East Alton, Ill.
Copper-base alloys—WESTERN

Westinghouse Electric Corp., East Pittsburgh, Pa.
Silicon-iron—HIPERSIL
Iron-nickel—CONPERNIK and HIPERNIK
Copper-base alloy—CUPALOY
Nickel-chromium-cobalt-iron alloy—K-42-B
Iron alloy—KOVAR A
Iron-cobalt alloy—HIPERCO
Phosphorus-copper—PHOS-COPPER

Wheelock, Lovejoy & Co. Inc., 128 Sidney St., Cambridge, Mass.
Chrome-manganese-molybdenum and chrome-nickel-molybdenum alloys—HY-TEN and ECONOMO

Wilson Co., H. A., 105 Chestnut St., Newark, N. J.
Contact and thermostatic metals—WILCO
Titanium-chromium-nickel—NI-SPAN C

Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., 1417 Central Ave., Detroit 9.
Tubing—WOLVERINE
See advertisement, Page 279

Alan Wood Steel Co., Conshohocken, Pa.
High-strength steel—"AW" DYNALLOY and DYNALLOY
Rolled-steel floor plate—"AW"

Worcester Wire Works, Div. of National Standard Co., Worcester, Mass.
Steel wire—WORCESTER Wire
See advertisement, Page 138

Worthington Pump & Machinery Corp., Harrison, N. J.
Corrosion and abrasion-resistant alloy — WORTHITE

Wyckoff Steel Co., First National Bank Bldg., Pittsburgh.
Cold-finished steel—WYCKOFF

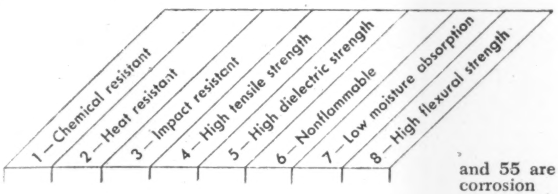
Y

Youngstown Alloy Castings Corp., Youngstown, O.
High tensile strength alloy—TRANTINYL

Youngstown Sheet & Tube Co., Youngstown, O
High strength alloy steel—YOLOY

Plastics Listed by Tradenames

(For listing by producing companies, and complete street addresses, see Page 216. For index of plastics by type, see Page 215.)



A

1 - - - - 6 - -
AMEROID—American Plastics Corp., New York 1. Casein thermoplastic; furnished in rods or sheets for machining. Abrasion resistance, medium; resistant to weak acids and organic solvents; softens when exposed to weak alkalies; decomposes when exposed to strong acids or alkalies. Max cont. serv. temp, 150 F; flexural str, 10,000-18,000 psi; dielectric str, 400-700 volts per mil; ts, 10,000 psi; comp str, 27-53 000 psi; impact str, 1.0 ft lb (Izod); produced in colors; moisture absorption, medium; sp gr 1.34; translucent and opaque; machinability, good; bhn 23. Used for bushings, knobs, etc.

B

1 2 3 4 5 6 7 -
BAKELITE—Bakelite Corp., New York.

1 - - - - 6 7 -
Phenolic plastics, general purpose; thermosetting; furnished in granular form for plastic molding; corrosion-resistant, dielectric strength at 60 cycles, 270-350 volts per mil.; nonflammable; ts. 6000-11.000 psi; low thermal conductivity: available in dark colors: takes high polish; low moisture absorption.

1 2 - - - - - -
Phenolic plastics, mineral filled. Similar to above. Has high heat resistance, low moisture absorption; and is nonflammable.

1 - 3 - 5 - - -
Phenolic plastics. fabric-filled. Similar to general purpose phenolic plastics but are much higher in impact resistance; abrasion-resistant; impact strength (Izod) .23-2.7 ft-lb energy to break. Used for gears, bushings, bearings and heavy-duty parts.

1 - - - 5 - 7 -
Polyethylene; thermoplastic; has good resistance to softening by high temperatures than any other similar material previously produced. Its outstanding characteristic is its unusually good electrical properties. It has extremely low coefficient of moisture absorption and water vapor transmission; resists the effects of practically all chemicals; is inherently flexible; can be produced as molded or extruded goods, sheet materials, film, sheeting or any of the other usual forms of plastic materials.

1 - - - 5 6 - -
Polystyrene plastics; thermoplastic; furnished in powder form for molding; transparent, translucent and opaque effects, in all colors; takes high polish; nonflammable: low moisture absorption; sp gr. 1.05-1.07; dielectric strength at 60 cycles 500-525 volts per mil.; volume resistivity 10 deg megohm centimeters; power factor .0002-.0003 from 60 cycles to 50 000 000 cycles: offers exceptional resistance to acids and alkalis.

Cast resins; produced as BT 44, 45. 48, 55 and 58 types: in rods, sheets, tubes and many special types of castings. BT 44, 45 and 55 are opaque, translucent and mottled; corrosion resistant; of high dielectric strength; low moisture absorption; available in colors. Used for radio cabinets, etc. BT 48 and 58 are crystal clear, transparent colors of any hue; and mottled transparents. Available as castings including rods, sheets and tubes; highly resistant to acids. Used in place of glass and can be readily machined and used for gages, peep holes, etc.

1 - 3 4 - - - -
BT 61-893; available in plates only; transparent water white; very stable; color-fast; excellent in dimensional stability. Used for photoelastic stress study work.

1 - - 4 - - - -
BT 41-001; available in transparent amber castings and sheets made to order; resistant to hydrofluoric acid. Used where very high dielectric strength and low moisture absorption properties are required.

BT-48-306; nonstatic, used for instrument windows and recommended under Navy specifications. This material has high light transmission qualities.

See advertisements, Pages 300, 311

1 - - - 5 - - -
BEETLE—Plastics Division, American Cyanamid Co., New York 20. Urea-formaldehyde base, thermosetting; furnished in powder or granules for molding purposes. Available in colors. translucent and opaque. Dielectric str, 300-350 volts per mil; ts, 5000-7000 psi; comp str, 20-24.000 psi; flexural str, 11-18,000 psi; shatterproof; moisture absorption, low; bhn 78.9; nonflammable. Used for housings, cabinets, knobs, dials and insulators.

- - 3 - - - - -
BUTACITE—E. I. du Pont de Nemours & Co., Arlington, N. J. Polyvinyl butyral. thermoplastic: furnished in sheets and flakes for laminating. Soluble in esters, alcohols, ketones, chlorinated hydrocarbons; insoluble in aliphatic hydrocarbons; stable in dilute alkalies and slowly decomposed in dilute acids. Dielectric str, 360 volts per mil; ts, 2000 psi; moisture absorption, high; sp gr, 1.07; transparent. Used for safety glass.

See advertisements, Pages 272, 317

C

1 - - - 5 6 - -
CATALIN (Electrical and mechanical)—Catalin Corp. of America, New York. Phenolic base, thermosetting: furnished in sheets, rods, tubes, or special shapes; also for casting into parts. Not affected by weak acids; decomposed by strong oxidizing acids; slight effect by weak alkalies. Max cont. serv. temp, 172 F: flexural str. 7500-18,000 psi (ASTM D 650-42T); dielectric str. 350-430 volts per mil; ts 5500-11,500 psi; str, 13.000-18 000 psi; impact str. 0.40-0.60 ft lb (Charpy), 0.25-0.45 ft lb (Izod): produced in ivory; moisture absorption. low: sp gr 1.316-1.317; opaque. For gears, housings, knobs and handles, chemical feed lines, etc.

- - 3 - 5 - 7 -
CELCON—Celanese Plastics Corp., New York 16. Ethyl cellulose, thermoplastic; available in granules for injection molding and extruding. Abrasion resistance, medium; good resistance to alkalies and weak acids, wide solubility in organic solvents; max cont. serv. temp depends on use and formula; flexural str, 4000-12,000 psi (ASTM D 650-42T); dielectric str, 400-520 volts per mil (⅛-in. thickness); ts, 2700-8000 psi; comp str, 8000-20,000 psi; impact str, 5.6-11.6 ft lb (Izod); available in all colors except crystal and pale pastels; moisture absorption, low; sp gr, 1.07-1.18; machinability, good. Used for electrical insulation and parts, motor housings, etc.

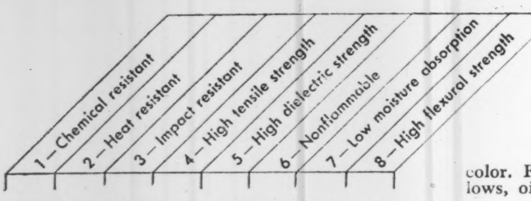
- - 3 - - - - -
CELLULOID—Celanese Plastics Corp., New York 16. Cellulose-nitrate base, thermoplastic; furnished in sheets, rods, tubes and films; for molding, swaging, veneering, machining or stamping into parts; available in colors, transparent, translucent and opaque. Abrasion resistance, medium; good resistance to sulphuric acid; soluble in lower alcohols, esters and ketones, insoluble in hydrocarbons. Max serv. temp depends on conditions; flexural str. 6000-15,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil (⅛-in. thickness): ts, 3000-11.000 psi; comp str, 20-30,000 psi; impact str, 2-6 ft lb (Izod); low moisture absorption; sp gr 1.35-1.57; machinability, good; bhn 5-11. For buttons, instrument dials, register wheels, etc.

1 - 3 - - - - -
CEL-O-GLASS—E. I. du Pont de Nemours & Co., Arlington, N. J. Plastic-coated wire mesh which transmits ultra-violet rays; corrosion-resistant: resistant to shock; translucent; flexible; light in weight. Used where an opalescent or translucent, flexible material is required.

See advertisements, Pages 272, 317

- - 3 - - - 7 8
CELORON—Continental-Diamond Fibre Co., Newark, Del. Phenol formaldehyde, thermosetting; furnished in sheet, rods, tubes for compression and transfer molding into parts, also molded parts and laminated forms; abrasion resistant; resistant to gasoline, kerosene, oil, grease, alcohol, acids and weak alkalies. Max cont. serv. temp, 250 F; flexural str, 21 000 psi (ASTM D-229-42); dielectric str, 220 volts per mil; ts, 11,000 psi: comp str, 40 000 psi; impact str, 3.6 ft lb (Izod); available in mottled tan and black; moisture absorption, low; sp gr 1.35; opaque. Used for electrical insulation, gears, pinions, cams, bushings, pulleys, casters, clutches, filter plates, handles, housings etc.

1 2 3 - - - - -
CEREX—Monsanto Chemical Co., Plastics Div., Springfield, Mass. A series of new thermoplastic compounds with ASTM heat distortion points of 212-256 F. Cerex X214 has ASTM heat distortion point of 220-230 F. Parts molded to close dimensional tolerances maintain dimension and mechanical strength during exposure at temperatures over the



boiling point of water. Material may be injection molded in standard machines. Excellent acid and alkali resistance, as well as carbon tetrachloride and aliphatic hydrocarbons. Electrical loss properties, good; available in light amber, also a wide range of transparent, translucent and opaque colors. For electronic instrument parts, and any applications where high heat resistance is required.

1 - 3 - 5 - - -
CHEMACO—Chemaco Corp., Berkeley Heights, N. J.

- - 3 - 5 - - -
Cellulose acetate; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by weak acids, weak alkalies and hydrocarbons; flexural str, 1500-12 000 (ASTM D 650-42T); dielectric str, 290-365 (⅛-in. thickness); ts, 3000-10,000 psi; comp str, 5000-30,000 psi; moisture absorption, medium; produced in color; sp gr, 1.27-1.37; transparent, translucent and opaque; machinability, excellent. For knobs, dials, controls, wheels, electrical insulation, shields, nameplates, washers, housings, etc.

- - 3 - - - - -
Ethyl cellulose; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, low; resists corrosion caused by weak acids and alkalies; heat resistant to 140-220 F; flexibility, low; flexural str, 3500-12,000 psi (ASTM D-650-42T); dielectric str, 400-700 volts per mil; (⅛-in. thickness); impact str, .6-11.5 ft lb (Izod); ts, 3000-10,000 psi; comp str, 8000-20 000 psi; moisture absorption, low; produced in pastels; sp gr, 1.07-1.18; translucent; machinability, good. For knobs, controls, trim, nameplates, etc.

- - - - 5 - - -
Polystyrene; thermoplastic; furnished in granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by alkalies and weak acids; heat resistant to 150-190 F; flexural str, 8000-19,000 psi (ASTM D 650-42T); dielectric str. 3500 volts per mil (0.005-in. thick); ts, 5000-9000 psi; comp str, 11.500-15.000 psi; moisture absorption, low; produced in color; sp gr, 1.054-1.056 (unpigmented); transparent, translucent and opaque. For use as knobs, dials controls, wheels, electrical insulation, shields, etc.

1 - - - 5 - - -
Vinyl: thermoplastic; furnished in powder for molding and extruding. Abrasion resistance, high; resists corrosion caused by alkalies and acids; heat resistant to 150 F; flexibility, low; dielectric str. 450 volts per mil; ts, 1000-9000 psi; moisture absorption, low; produced in color; shatterproof; sp gr, 1.2-1.6; transparent, translucent or opaque; machinability, good. Used for knobs, dials, controls, wheels, electrical insulation, shields, etc.

1 2 - - 5 - - -
CIBANITE—Ciba Products Corp., Hoboken, N. J. Aniline formaldehyde resin, thermoplastic; furnished in powder form for molding. Abrasion-resistant; resists corrosion caused by alkalies; heat-resistant up to 247 F; flexibility, low; dielectric strength, 400-600 volts per mill; ts, 8200 psi; comp str, 24.000 psi; moisture absorption, 0.01-0.08 per cent; available in natural brown color; impact str. 0.30 ft lb; sp gr, 1.22-1.25; translucent; machinability, good. For use where good strength with electrical properties are required, such as for stator insulation, tube bases, coil forms, terminal boards, strips and blocks.

1 - - - - - 7 8
CLEARSEAL—Cleaveland Laboratories & Mfg. Co. Inc., Peapack, N. J. Vinyl resin applied to fabric and paper, also other synthetic rubbers and covers; both thermosetting and thermoplastic, in sheet and laminated form; for molding, sewing and cementing. Abrasion resistance, high (for fabric); resists corrosion caused by acids, alkali, salts and gasoline; max. cont. serv. temp. 250F; flexibility, high (or changed as desired); moisture absorption, may be varied as required; available in any color. For machine covers, diaphragms, bellows, oil or grease retaining jackets, etc.

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COMPAR—Resistoflex Corp., Belleville, N. J. Compounded, modified polyvinyl alcohol base material; furnished in sheets, rods or tubes, for molding and extruding. Abrasion resistance, high; heat resistant to 250 F; flexibility, high; ts, 2500-5200 psi; moisture absorption, medium; sp gr, 1.26; translucent; hardness, 65-100. For flexible hose connections and assemblies for low and medium pressure hydraulic systems, and lubricating systems. Gaskets and molded parts.

- - 3 4 - - - -
CO-RO-LITE—Columbian Rope Co., Auburn, N. Y. Phenolic base resin material, furnished in sheet form for molding into parts. Abrasion resistance, high; heat resistant to 350 F; flexibility, medium; ts, 11,000 psi; flammable; can be highly polished; opaque; and can be produced in color. Used for cams, gears, bobbin heads, bearings, tension and compression members, etc.

1 - 3 - - - - 8
COTTONLEATHER Fabric—Southern Friction Materials Co., Charlotte, N. C. Cotton fabric base with resinous impregnation, thermosetting; furnished in sheets for stamping. Abrasion resistance, high; max cont. serv. temp, 250 F; flexibility, low; dielectric str, low; ts, 2000 lb modulus of rupture; comp str, high; moisture absorption, medium; takes color; shatterproof; sp gr, 1.0; opaque. For pulleys, frictions, pads, shims, etc.

D

- - 3 4 - - - 8
DIAMOND FIBRE—Continental-Diamond Fibre Co., Newark, Del. Cellulose hydrate material; furnished in laminated sheets, rods, tubes and formed parts. Abrasion resistance, high; gasoline, kerosene, oil, grease and alcohol resistant; max cont. serv. temp, 220 F; flexural str, 13,000 psi (ASTM D-229-42); dielectric str, 150 volts per mil; ts, 8000 psi; comp str, 30 000 psi; impact str, 5.5-8.0 ft lb (Izod); produced in gray, white, black and red; moisture absorption, medium; sp gr, 1.1-1.4; opaque; bhn 15. For electrical insulation, gaskets, water seals, bobbins, handles, housings and gears.

1 - - - 5 - 7 -
DILECTENE—Continental Diamond Fibre Co., Newark, Del. Pure aniline-formaldehyde thermoplastic which contains no cellulosic filling materials. Furnished in sheets, rods and tubes for compression molding; resists alkalies, weak acids, alcohol, benzene toluene and gasoline. Max cont. serv. temp, 180 F, flexural str, 18.000 psi (ASTM D 229-42); dielectric str, 600 volts per mil; ts, 10.000 psi; comp str, 20 000 psi; impact str, 0.35 ft lb (Izod); available in red-brown; moisture absorption low; transparent. Used for electrical insulation.

- - - 4 5 - - 8
DILECTO — Continental-Diamond Fibre Co., Newark, Del. Phenolic base, thermosetting; furnished in sheets, rods and tubes for compression molding; also available in post formed parts. Abrasion resistance, high; resistant to gasoline, kerosene, oil, grease, alcohol, acids and weak alkalies. Max cont. serv. temp, 250 F; flexural str, 19 000 psi (ASTM D-229-42); dielectric str, 700 volts per mil; moisture absorption low; ts, 12 000 psi; available in tan and black; impact str, 1.1 ft lb (Izod); takes high polish. Used for cams, bushings, nameplates, baffle plates, thrust washers, valve seats, bobbins, pulleys and spacers.

- 2 3 4 - - - -
DILECTO Glass Fabric—Continental-Diamond Fibre Co., Newark, Del. Phenol formaldehyde thermosetting material; furnished in sheets, rods and tubes for compression molding. Abrasion resistance, high; gasoline, kerosene, oil, grease, alcohol, acid and weak alkali-resistant. Max cont. serv. temp, 350 F; flexural str, 21,000 psi (ASTM D-229-42); dielectric str, 600 volts per mil; ts, 24,000 psi; comp str, 44,000 psi; impact str, 10.0 ft lb (Izod); produced in natural color; moisture absorption, low; sp gr, 1.6; opaque. For electrical insulation.

1 2 - - - - 7 -
DURALON—The U. S. Stoneware Co., Akron, O. Furane base; thermoplastic; for casting, machining, surface coating or laminating; abrasion resistance, high; resists corrosion caused by chemical or solvent action; heat-resistant to 400 deg F; flexibility, medium; dielectric strength, over 5000 volts per mil; moisture absorption, low; produced in black; shatterproof with certain fillers and in certain shapes; sp gr, 1.1; opaque; machinability, good; hardness, 110 Rockwell M (depending on cure); soluble in nothing after cure, except strong oxidizing acids. For light metal stamping dies, solvent proof coatings, cast electrical insulating parts, etc.

1 - - 4 - - - -
DURASHIELD—Plastic Fabricators Inc., San Francisco. Cellulose acetate, thermoplastic; can be fabricated to any size, shape, thickness or color; can be die cut and punched. Abrasion resistance, low; resists corrosion caused by salt spray and moisture; heat-resistant to 170 F; flexibility, high; shatterproof; moisture absorption, low; transparent, translucent and opaque. For nameplates.

1 - - - 5 - 7 -
DUREZ—Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.

Molding powders; phenolic base, thermosetting; for molding into parts; corrosion-resistant; highly polished; low moisture absorption; heat resistance, 350-550 F; ts. 4000-7000 psi; available in colors; shock and abrasion resistant. Used for housings, handles, bases, knobs, electrical parts, small gears, frames, hoods, etc.

Liquid resin (No. 7421A); cast at low temperatures; compressive str, 15,000-20,000 psi; impact str, .11-.15 ft lb (Izod); flexural str, 7000-9000 psi; thermosetting; can be set by baking at temperatures above 100 C.

1 - 3 - 5 - - -
DURITE—Durite Plastics Inc., Frankford Sta., P.O., Philadelphia. Phenol furfural and phenol-formaldehyde synthetic resins, thermosetting; available in crushed, pulverized or liquid form, for compression or transfer molding. Excellent resistance to weak acids and alkalies; max cont. serv. temp, 400 F; flexural str, to 30,000 psi; dielectric str, 400-1000 volts per mil; ts, 8000-12,000 psi; comp str, 20-40.000 psi; impact str, 15.0 ft lb (Izod); available in all shades except white and pastels; moisture absorption, low; sp gr 1.2-2.09; opaque. For gears, ignition parts, automotive parts, housings, condenser parts, control panels, hand wheels, and pulleys.

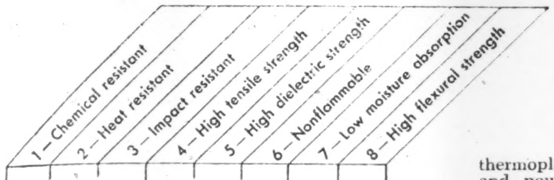
E

1 - - - 5 - 7 -
EBROK—The Richardson Co., Melrose Park, Ill. Acid-resisting bituminous plastic for specific requirements including such parts as battery containers.

See advertisement, Page 162

1 - - - 5 - 7 -
ELASTI-GLASS—S. Buchsbaum & Co., Chicago 16. Vinylidene chloride copolymers and vinyl chloride acetate copolymers, thermoplastic; furnished in sheets and rolls or film, and in extruded rods or shapes; also for compression molding and extruding into parts. Chemically resistant to almost all solvents. Has high dielectric str; available in all colors; moisture absorption, low. For diaphragms, valve seats or protective covers.

1 - 3 - - - - 8
ELASTRON—Industrial Synthetics Corp., Irvington 11, N. J. Flexible plastic of polyvinyl family; furnished glossy to smooth dull finishes for stamping, embossing and printing; available in variety of colors, transparent, translucent or opaque; exceptionally tough; flexible; light in weight; nonflammable; inert to alcohol or oil splashes, salt water proof. For bumpers for household appliances, and other industrial applications.



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ELVACET Polyvinyl Acetate—E. I. du Pont de Nemours & Co., Arlington, N. J. Thermoplastic; supplied in solid beads of low, medium and high viscosity for molding or casting, in solution (50 per cent in methanol), and as water emulsion. Soluble in common organic solvents for use as adhesive, compatible with resins, cellulose derivatives and chlorinated rubber. Used as adhesive, binding agent, also as protective coating on machine parts.

See advertisements, Pages 272, 317

1 - - 4 - - - -

ELVANOL—E. I. du Pont de Nemours & Co., Arlington, N. J. Polyvinyl alcohol, thermoplastic; in powder form for molding and solvent-resistant rubber substitutes, textile sizings, paper coatings, and adhesives. Highly flexible; dielectric strength, low; heat resistant to 200 F; takes color; shatterproof; sp gr, 1.21-1.31 (powder); translucent; resistant to organic solvents. Used for oil resistant gaskets, tubes, rollers, etc., as well as protective coatings on metal parts.

See advertisements, Pages 272, 317

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ETHOCEL—The Dow Chemical Co., Midland, Mich. Plastic granules, thermoplastic; furnished in granular form for injection and extrusion molding; dielectric str, 1500 volts per mil on .01-in. thickness; ts, 7000-8500 psi; comp str, 10-12,000 psi; heat resistance, 130-150 F; high impact strength at low temperature; low moisture absorption; good dimensional stability; available in color; sp gr, 1.10-1.25; translucent; opaque. Used where dimensional stability is required. Also furnished in sheeting.

F

1 - 3 4 5 - 7 -

FARLITE—Farley & Loetscher Mfg. Co., Dubuque, Ia.

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Phenolic and urea base, thermosetting materials; for machining and stamping into parts; corrosion-resistant; highly polished, low moisture absorption; impact-resistant; available in colors; ts, 10-12,000 psi; dielectric str, to 700 volts per mil. Used for circuit barriers, panel boards, washers, terminal strips, and for parts requiring moderate chemical resistance.

1 - 3 4 - - - -

Gear stock; fabric base. Furnished in blanks of desired thickness; high moisture resistance; ts, to 11.000 psi; comp str, 39,500 psi; flex str, to 20.000 psi; and dielectric str, to 700 volts per mil.

1 - 3 - - - - -

Safety tread; abrasive surface material bonded with phenol-formaldehyde resin under heat and pressure to metal, resinous sheet stock or wood. Abrasive material hardest known except diamond. Very coarse to fine; water-resistant: no distortion at less than 300 F; furnished in sheets or fabricated form to specifications; molded to simple shapes. Used for stairways; catwalks and machine platforms on buses, trains, ships and airplanes.

- 2 - 4 - - 7 -

FD Resins—Interlake Chemical Corp., Cleveland 14: Thermosetting liquid phenolics which may be polymerized by heat. Cured resins retain high degree of strength dimensional stability, resistance to heat and low moisture absorption. Applications include bonding of mineral wool for insulation, impregnation of paper and cloth for making plastic laminates. preparation of thermosetting molding powders and treatment of veneer in making high density impregnated plywood.

1 - - 4 5 - - -

FIBESTOS—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cellulose-acetate; thermoplastic; furnished in sheet, laminated and powder forms or rods and tubes, for molding, machining, stamping or swaging into parts; resistant to corrosion; transparent; available in colors; flexible; tough; high polish; dielectric str, 290-600 volts per mil; ts, 5500-10,000 psi. Used for safety glass, and compressible shims, couplings, gaskets, electrically insulated knobs and handles, light diffusing panels, and molded shapes of all types.

1 2 - - 5 - - -

FIBRON—Irvington Varnish & Insulator Co., Irvington, N. J.

Plastic tape; polyvinyl chloride, thermoplastic; heat-sealing, flame-resistant tape for insulating and protecting against abuse and corrosion of wires, cables and electrical equipment; suitable also for splicing electrical cables and for covering piping and equipment exposed to acids, alkalies, moisture, oil and grease. Dielectric str, 1000 volts per mil for tape of 0.012-in. thickness; ts, 1600 psi.

Plastic tubing, No. 5373; polyvinyl chloride, thermoplastic; furnished in rods and tubes for extruding. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 180 F; dielectric str, 1000 volts per mil; ts, 3000 psi; available in black, green, red, white, yellow and blue; moisture absorption, low; and machinability, good. For wire insulation, conduit, lug insulation, etc.

- - - 4 - 6 7 -

FORMALIN—National Plastic Products Co., Detroit. Phenol-formaldehyde, thermosetting; furnished as a liquid casting resin. Abrasion resistance, high; dielectric str, 225 volts per mil (4 per cent resin); ts, 5000 psi; comp str, 12.000 psi; moisture absorption, low; sp gr, 1.3; opaque; machinability, good. For knobs, handles, etc.

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FORMICA—Formica Insulation Co., Cincinnati. Resinous base, thermosetting; furnished in laminated form, for machining or stamping into parts; corrosion-resistant: tensile strength is slightly less than cast iron; high dielectric strength; absorbs no oil; changes in dimensions only slightly as the result of moisture absorption. Used for insulating washers and bushings, punched parts in switches, automotive starting systems and all types of heavy-duty gears.

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Grade C; phenolic laminated fabric; thermosetting; furnished in sheets and in rods or tubes: can be highly polished; corrosion-resistant to acids and salts, not alkalies; flexible in thin sections; dielectric str, 200 volts per mil in 1/16-in. thick: ts, 10 000 psi· heat resistant to 300 F. Used for silent gears.

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Grade CNP-22; laminated phenol-formaldehyde: furnished in sheets. rods or tubes for machining into parts. Abrasion resistance, high: resistant to all electroplating solutions except chromic acid: max cont. serv. temp, 275 F: flexibility. low; dielectric str. 200 volts per mil: ts, 7500 psi; flex str, 12.500 psi; moisture absorption. low: shatterproof: sp gr, 1.36: opaque: available in natural (tan); machinability. fair. For chemical resistant parts such as gears and panels for electroplating equipment.

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Grade CIP-11 and CBP-11: laminated phenol-formaldehyde. thermosetting materials; furnished in sheets up to 36 x 96 in : Abrasion resistance, medium; max cont. serv. temp, 275 F· flexural str, 17.000 psi (ASTM D 650-42T); ts. 9000 psi: comp str. 36 000 psi (flat): available in olive green (CIP-11), and black (CBP-11); moisture absorption, medium; sp gr. 1.36: opaque: machinability, good. A post-forming grade for bending or drawing into various shapes after pressing. Formed shapes have good rigidity and dimensional stability.

- 2 3 - - - - -

Grade FF-54; melamine resin, glass fabric base, thermosetting material furnished in rods or tubes and in laminated form for molding into parts; abrasion resistance, high; resists corrosion caused by mild alkalies; heat resistant to 300 F; flame resistant; dielectric str, 500 volts per mil; ts, 25,000 psi; sp gr, 1.95; opaque. For panelboards and other applications requiring good arc and flame resistance.

- 2 3 - - 6 - -

Grade FF-55; melamine formaldehyde, thermosetting; furnished in laminated sheets up to 36 x 96 in., and in rods and tubes Abrasion resistance, medium; chemical resistance, not recommended except for use with water or very mild alkali solutions. max cont. serv. temp, 390 F; flex str, 35.000 psi (facewise) and 40.000 psi (edgewise) (ASTM D 650-42T); dielectric str, 500 volts per mil; ts, 25.000 psi; comp str, 55.000 psi (flat); impact str, 12 ft lb/in. notch (Izod); available in light brown, opaque: moisture absorption, medium. For parts requiring good arc and fire resistance together with good mechanical strength, such as electrical instrument panel boards.

1 - - - - - 7 8

Grade LN-41; laminated melamine formaldehyde, thermosetting; furnished in sheets, rods or tubes for machining. Abrasion resistance, medium; very resistant to alkaline solutions but poor resistance to acids; max cont. serv. temp, 280 F; flexibility, low; ts, 20 000 psi; dielectric str, 370 volts per mil: comp str, 44.000 psi; flexural str, 26,000 psi; moisture absorption, low; produced in ivory. opaque; sp gr, 1 5; shatterproof. For electroplating barrel parts for alkaline solutions and other electrical fabricated parts requiring electrical arc resistance.

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Grade MF; aniline-formaldehyde-glass thermosetting material; furnished in rods, tubes and laminated sheets, for molding, machining or stamping into parts; corrosion-resistant; heat-resistant to 280 F; flexibility, medium; ts, 14,000 psi; comp str, 20.000 psi; dielectric str, 450 volts per mil, moisture absorption. low; nonflammable; shatterproof; opaque. For low-power loss insulation, to replace glass and porcelain parts in antenna mast bases, molded insulators, spacers. washers, etc.

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Grade XX; phenolic laminated paper; thermosetting; furnished in laminated form and in rods or tubes; can be highly polished: dielectric str, 500 volts per mil; ts 12.000 psi: heat resistant to 300 F; available in natural and black; low moisture absorption Used for insulation for electrical equipment

See advertisement, Page 270

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FORTICEL—Celanese Plastics Corp., New York 16. Cellulose propionate, thermoplastic; available in granules for injection and compression molding. Abrasion resistance, medium; wide solubility in organic solvents; max cont. serv. temp depends upon use and formula: flexural str 4800-10.000 psi (ASTM D 650-42T); dielectric str, 370-425 volts per mil (⅛-in. thickness): ts. 2800-6000 psi. impact str, .08-11.4 ft lb (Izod): available in colors; transparent, translucent and opaque moisture absorption low: sp gr. 1.17-1.22; machinability, good. For vacuum cleaner parts, housings, radio cabinets, etc

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FV—Irvington Varnish & Insulator Co., Irvington, N. J. Flexible lacquered tubing for electrical insulation; meets ASTM and VTA standards for grade A-2 flexible varnished tubing; resistant to aging. oil. moisture, acid vapors, weak alkalies. Obtainable in five colors.

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GARIT—Garfield Mfg. Co., Garfield, N. J. Thermosetting, cold-molded plastic; corrosion-resistant: dielectric strength, 50-60 volts per mil; ts. 1200 psi; heat resistance, 500 F, moisture absorption, 2 per cent, nonflammable: comp str, 7500 psi. Used for molded insulation for electrical equipment.

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GEMFLEX—Gemloid Corp., Elmhurst, L. I., N. Y. Vinyl chloride acetate, thermoplastic; furnished in rods or tubes, and for molding and extruding into parts. Has excellent resistance to acids, alkalies, oils and waters. Max cont. serv. temp, 150-160 F; dielectric str, approximately 1100 volts per mil; ts, 2500 psi; moisture absorption, low; transparent, translucent and opaque; strong and tough at lower than freezing temperatures; high fatigue strength; unusual flexibility. For insulating, gasketing, etc.

1—Chemical resistant
2—Heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Low moisture absorption
8—High flexural strength

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GEMLITE—Gemloid Corp., Elmhurst, L. I., N. Y. Acrylic butyrate, thermoplastic; furnished in laminated sheet, rods or tubes and for injection molding; corrosion and impact-resistant; high tensile and dielectric strengths; max cont. serv. temp, 150-160 F; nonflammable; takes high polish; transparent, opaque and translucent; available in colors; moisture absorption, low; good machinability. Used for handles, knobs, nameplates, dials, etc.

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GEMLOID—Gemloid Corp., Elmhurst, L. I., N. Y. Thermoplastic and thermosetting material, furnished in sheet and laminated form for stamping into parts; abrasion resistance, medium; heat resistance for thermoplastics is 175 F and for thermosetting type, 400 F; ts, 4000-6000 psi; moisture absorption, low; non-flammable. Used for replacing metal nameplates.

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GEON—B. F. Goodrich Chemical Co., Cleveland. Polyvinyl chloride, thermoplastic; furnished in sheets and granules for injection and compression molding, extruding, calendering and solution coating. Excellent chemical resistance except for ketones and chlorinated hydrocarbons. Max cont. serv. temp, 150 F; dielectric str, 800-1000 volts per mil; ts, to 3500 psi; produced in all NEMA colors, transparent, translucent and opaque; moisture absorption, low; sp gr, 1.3. For various applications such as for electrical insulation, beverage tubing, gasket and packing material, automotive body or refrigerator strips; etc.

See advertisement, Page 142

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GUMMON—Garfield Mfg. Co., Garfield, N. J. Black, cold-molded; corrosion and heat-resistant (450 F); high dielectric strength; high polish; resistant to hot oil. Will not shrink, crack, warp or deteriorate with age; takes high polish; nonflammable. Used for insulated parts, etc.

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HARVEL Oil Stop—Irvington Varnish & Insulator Co., Irvington, N. J. Oilproof, waterproof, heat-resistant, phenol-aldehyde used in splicing electrical cables; to seal and insulate electrical coils. Applied as a viscous liquid, it hardens by polymerization to an infusible, nonthermoplastic state; adheres to rubber, oil-impregnated paper, varnished cambric, fiber, bakelite and copper.

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HEMIT — Garfield Mfg. Co., Garfield, N. J. Cold-molded, gray-white refractory material; corrosion-resistant; heat resistance, 1500-1750 F; low moisture absorption when impregnated; high dielectric strength; nonflammable. Used for interior parts of heating devices, or where a molded part must withstand an arc.

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HIDEN—Parkwood Corp., Wakefield, Mass. Laminated plastic furnished in plates for machining. Abrasion resistance, medium; resists weak acids and alkalies; max cont. serv. temp, 200-250 F; slow burning; rigid; dielectric str, 200-500 volts per mil; ts, 35,000 psi; comp str, 20,000 psi; flexural str, 30,000 psi; moisture absorption, low; available in amber color; opaque; sp gr, 1.30-1.35; machinability, good. For use where lightweight and strength are required, such as textile picker sticks, etc.

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HYFLEX—Irvington Varnish & Insulator Co., Irvington, N. J. Flexible, rubber-like extruded plastic tubing; has excellent abrasion resistance; does not become brittle at temperatures as low as —50 F; obtainable in six opaque colors; dielectric str, 1200 volts per mil (dry), 1000 volts per mil (wet), for tubing of wall thickness approximately 0.02-in.; ts, 3000 psi; good chemical stability. For moderately low-temperature applications, wire insulation, conduit, lug insulation, low-pressure hose.

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INCELOID—American Products Mfg. Co., New Orleans. Cellulose derivative, thermoplastic; furnished in sheets for extruding. Abrasion resistance, medium; resistant to mild acids and alkalies, water, hydrocarbons; max cont. serv. temp, 180 F; dielectric str, about 800 volts per mil; ts, 9000 psi; comp str, 11,000 psi; produced in color; moisture absorption, medium; sp gr, 1.27; translucent and transparent; machinability, good. For use as heat and electrical insulating covering.

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INDUR—Reilly Tar & Chemical Corp., Indianapolis. Phenolic base, thermosetting; furnished in powder form, for molding into parts; ts, 8560 psi; high dielectric strength; nonflammable; low moisture absorption; high heat resistance; corrosion and abrasion-resistant; available in colors; flexibility, medium; sp gr, 1.37±. Used for instruments and machine accessories including insulating panels, knobs and handles, control levers, gears, etc.

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INDUR VARNISH—Reilly Tar & Chemical Corp., Indianapolis. Phenolic base, thermosetting; for molding into parts; high dielectric and tensile strengths; nonflammable; transparent; corrosion and high heat-resistant; impact-resistant; and low moisture absorption. Used for laminated gears.

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INSUROK—The Richardson Co., Melrose Park, Ill.

Thermosetting type; furnished in laminated sheets, rods and tubes for machining into parts, or as finished molded parts; corrosion-resistant; low moisture absorption; high tensile strength; resistant to shock; comparatively low specific gravity. Used for gears, bearings, electrical insulation. Available in different grades.

Thermoplastic type; furnished in molded parts; high dielectric strength; low moisture absorption; high tensile strength; low specific gravity. Available in color.

Translucent type; urea or phenolic base, thermosetting; in laminated sheets and fabricated parts, for instrument dials, etc. Material is translucent, does not support combustion, and has low moisture absorption.

See advertisement, Page 162

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INTERLAKE Resin 4585—Interlake Chemical Corp., Cleveland 14. Resin for impregnating papers. Papers can be molded at relatively low temperatures and pressures (75-300 psi); possess excellent strength properties, high resistance to water absorption; show only a slight tendency to swell upon immersion in water. Strength characteristics follow grain direction of sheets.

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IRVINGTON—Irvington Varnish & Insulator Co., Irvington, N. J. Varnished fabrics; varnished cambric, canvas, cotton, duck, Fiberglas, silk, Nylon, rayon and SIC, thin cotton (alternates for silk). Varnished papers; ranging from thin condenser tissues to heavy fibrous types.

Plastic marker insulators; extruded plastic tubing sleeves, marked to specifications; serve both as wire markers and lug insulators; high dielectric strength; resistant to heat, acids, alkalies, oil and many solvents; do not support combustion. Obtainable in numerous color combinations, and in standard tubing sizes.

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Transformer lead tubing; made to specifications, consisting of several layers of varnished cambric over which saturated braid has been drawn; assembly is dipped in varnish and thoroughly baked.

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Varnished markers; short lengths of varnished tubing marked to specifications. Used to identify leads; inside-and-out coatings resist oil, gasoline, washing down of motors, high engine temperature.

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IRV-O-LITE XTE 30—Irvington Varnish & Insulator Co., Irvington, N. J. Thermoplastic, furnished in rods, tubes and for extruding. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 170 F; flexibility, high; dielectric str, 1000 volts per mil; moisture absorption, low; produced in black, green, white, yellow, red and blue; sp gr, 1.293; opaque. For wire insulation, conduit, lug insulation, etc.

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IRV-O-SLOT—Irvington Varnish & Insulator Co., Irvington, N. J. Stator or armature slot insulation; thinnest types are resin-coated papers, others consist of varnished fabric duplexed to fish or 100 per cent rag papers; flexible binding adhesive prevents separation during shaping and forming, contributes to insulating qualities. Obtainable in a wide variety of combinations and thicknesses in the form of sheets, tape and punchings.

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IRV-O-VOLT—Irvington Varnish & Insulator Co., Irvington, N. J. Flexible varnished inside-and-out tubing; obtainable in six colors. Braided cotton sleeving, treated with oleoresinous varnishes.

Types A-1, B-1, C-1 and C-2; conform to ASTM and VTA specifications for similarly designated grades; inside varnish coating yields a smoother inside wall, speeding assemblies; greatly retards moisture absorption; eliminates feathering action of ordinary braid and wicking action when used in oil-filled transformers; provides margin of insulation protection should outside coating become chafed.

Type CT; special heavy-walled saturated sleeving.

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IVI-FLEX—Irvington Varnish & Insulator Co., Irvington, N. J. Flexible extruded plastic tubing, developed for use at extremely low temperatures; dielectric str, 600 volts per mil, wet or dry; ts. 1000 psi; elongation at break, 400 per cent.

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IVORICAST—West Coast Plastic Enterprises, Los Angeles 32. Phenol formaldehyde, thermosetting; furnished as a casting resin; chemical resistance, excellent; max cont. serv. temp, 300 F; ts, 10.000 psi; comp str, 20 000 psi; impact str, 4 ft lb (Izod); moisture absorption, low; sp gr, 1.24; translucent and opaque, in any color. For small gears, caps, washers, gaskets, insulators, etc.

K

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KEM-POL—The Sherwin Williams Co., Cleveland. Vulcanizable polymer derived from vegetable oils, thermoplastic; furnished in sheets and liquid; for molding, extruding and calendering; ts, 300-500 psi; takes color; hardness 40-65. Available in four different grades.

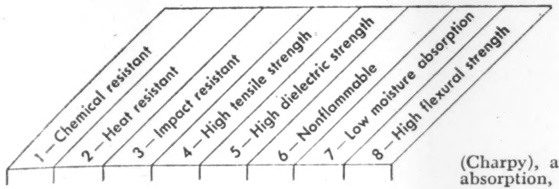
No. 14; viscous liquid, amber in color; easily soluble in aliphatic and aromatic hydrocarbons; may be emulsified.

No. 54; of intermediate viscosity; tacky, semisolid gel-like material; soluble same as above; may be cured, milled and molded.

No. 11; most viscous of the untreated polymers; tacky solid, and darker in color than two above, being ruby red; soluble with difficulty if at all; can be emulsified.

No. 11-41 MP; based on No. 11 and represents this polymer in a precured state; dry, cream to tan colored sheet, with only slight tack; may be worked directly on rubber mill, without pretreatment.

Used for hose, rolls, braided tubing, pads, gaskets, insulation, fabric coatings, tapes, beltings, etc.



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KRISTON "A"—B. F. Goodrich Chemical Co., Cleveland. Allyl ester, thermosetting; furnished in crystals for casting and "contact" laminating. Has medium abrasion resistance and excellent chemical resistance. Max cont. serv. temp. 226 F (heat distortion point—66 psi fiber stress); flexural str, 1400 psi; dielectric str, 1275 volts per mil; ts. 19 600 psi; impact str, 0.2 ft lb (Izod); furnished in natural clear form but can be made any color by fabricator; moisture absorption, low; machinability, fair. For viewing ports, nameplates and control knobs, by casting; and gear covers and other semistructural parts by laminating.

See advertisement, Page 142

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KYS-ITE K-100—Keyes Fibre Co., Waterville, Me. Phenolic fiber base, thermosetting; for molding into parts. Abrasion resistance, medium; resists corrosion caused by water, mild acid and alkali; flexural str, 12.500-18,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil; ts, 4500-12.000 psi; comp str, 35.000 psi; moisture absorption, low; impact str, 1.7-4.4 ft lb (Izod); produced in medium and dark shades; shatterproof; sp gr, 1.39-1.45: opaque; machinability, good. For handwheels, small structural parts, and other machine parts.

L

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LAMICOID—Mica Insulator Co., New York. Phenolic and urea base thermosetting laminated sheets, rods and tubes: for machining and stamping into parts; can be furnished highly polished or satin; abrasion resistance, high; heat resistant to 250 F; moisture absorption, low; furnished in natural and black; impact-resistant: and has high dielectric strength. Used for gears, electrical and mechanical insulation, instruction charts, dials, etc.

LAMINAC—American Cyanamid Co., New York 20. An unsaturated polyester resin, for laminating or casting; furnished in various grades. Ts. 41,500 psi; comp str, 14 900 psi.; impact str (flatwise), 33 ft lb (Izod); heat resistance depends on filler.

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LAMINEER—General Plastics Corp., New York 19. Laminated plastics furnished in sheets, for molding. Abrasion resistance, high; chemical resistance, excellent to mild acids and alkalies, alcohol and other solvents. Max cont. serv. temp. 250 F; nonflammable; dielectric str, high; moisture absorption, low; available in all colors, translucent and opaque; shatterproof; sp gr. 1.35; machinability, good. For any application requiring a combination of excellent resistance to chemical attack and abrasion with attractive appearance.

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LAMITEX—Franklin Fibre-Lamitex Corp., Wilmington, Del. Laminated Bakelite phenolic, thermosetting; furnished in sheets, rods or tubes in laminated form for machining, punching and screw machine work. Abrasion resistance high; heat resistant to 300 F; dielectric str. 150-750 volts per mil; ts. 7500-12 500 psi: comp str. 32,900-38 000 psi; moisture absorption, low; produced in black and natural: sp gr. 1 36-1.38; opaque. For all parts for radio radar, communication systems, airplanes, vessels, tanks, trucks, automobiles, etc.

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LOALIN—Catalin Corp., New York. Polystyrene thermoplastic; furnished in granules for injection and compression molding and extruding. Exceptionally good resistance to acids, alkalies and salts; max cont. serv. temp. 168-176 F; flexural str. 8000-9500 psi (ASTM D 650-41T) dielectric str, 500-700 volts per mil: ts. 5500-7000 psi; comp str, 14-16,000 psi; impact str .30-.35 ft lb (Charpy), and .30-.40 ft lb (Izod); moisture absorption, low; sp gr, 1.054-1.070; transparent, translucent and opaque; good machinability. For insulators, refrigerator fittings, etc.

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LUCITE—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Methyl-methacrylate base, thermoplastic; furnished in powder for molding or sheets, rods and tubes for machining into parts. Parts injection molded or extruded have following characteristics: High abrasion resistance; unaffected by weak acids and alkalies; attacked by strong acids and alkalies: soluble in lower ketones and esters. Max cont. serv. temp, 216 F; flexural str, 19,600 psi (ASTM D 650-42T); dielectric str, 400 volts per mil; ts, 10,400 psi; comp str, 16,000 psi; impact str, 0.3-0.5 ft lb (Charpy); 0.4 ft lb (Izod); available in color; moisture absorption, low; transparent, translucent and opaque. For pumps, marine engine water-strainer sections, automatic feeder and lubricator parts, oscillator housing caps, etc.

See advertisements, Pages 272, 317

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LUMARITH—Celanese Plastics Corp., New York 16.

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Cellulose acetate base, thermoplastic; furnished in sheets, powder or rods and tubes; powders for compression, injection and extrusion molding. Available in colors; ts, 3000-15,000 psi; dielectric str, 285-365 volts per mil (⅛-in. thickness); high polish; flexible; resistant to shock and corrosion. Used as interior electrical parts, instruments, aircraft lever knobs, electric insulation, steering wheels, automotive door and window handles, gas mask lens, etc.

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Cellulose acetate base, thermoplastic; furnished in sheets and rolls or reels in thicknesses of 0.0007-0.20 for laminating, swaging, drawing or stamping into parts. Abrasion and corrosion-resistant; flexible; dielectric str, 700-2500 volts per mil; ts, 4500-11.000 psi; heat-resistant to 275 F; slow burning to nonflammable; transparent. Used for ammunition components, laminated slot insulation for motors; spirally wound tubing is used for insulating tool handles and interior electrical parts.

CA; cellulose-acetate base, specially developed for aircraft use in such applications as windows, cockpit enclosures, antennae housings, etc.; tough; has high clarity and optical uniformity; resistant to sunlight and can be heat-formed into three-dimensional shapes without surface impairment. Some of these materials are light stabilized having greater weather resistance; also for filtering out ultra-violet rays. It is abrasion-resistant.

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LUSTRON—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Polystyrene; thermoplastics; styrene base: furnished in powder for molding into parts: abrasion resistance, fair: can be highly polished: corrosion-resistant; dielectric str. 500-700 volts per mil: ts 6000-7000 psi: low moisture absorption: available in color: sp gr. 1.054-1.070; clear to opaque. Used for electrical insulating parts, etc.

M

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MAKALOT Molding Compounds — Interlake Chemical Corp., Cleveland 14. Phenol-formaldehyde resins and compounds; thermosetting; supplied in various forms, but mostly as a granular powder and in a wide range of flows to be molded under heat and pressure; for a wide variety of molding applications to best meet specific requirements.

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MEADOL—The Mead Corp., Chillicothe, O. Lignin, thermoplastic; furnished in powder for compression molding. Abrasion resistance, medium; max cont. serv. temp. 302 F; flexural str. 26.000 psi (Federal Spec. No. 1031); ts. 22.000 psi; comp str, 14 000 psi; impact str, 9.50 ft lb (Charpy); moisture absorption, medium; sp gr, 1.4; available in black; machinability, fair.

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MECOBOARD—Continental-Diamond Fibre Co., Newark, Del. Phenol-formaldehyde, thermosetting: furnished in sheets, rods, tubes and for compression molding. Abrasion resistance, medium; max cont. serv. temp, 220 F; flexural str, 22.000 psi (ASTM D-229-42); dielectric str, 475 volts per mil: ts, 9500 psi; comp str, 31.000 psi: impact str, 6.5 ft lb (Izod); moisture absorption, low; translucent; machinability, good. Used for electrical insulation.

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MELMAC—Plastics Division, American Cyanamid Co., New York 20.

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592; melamine formaldehyde, thermosetting; furnished in granules for molding into parts. Has high abrasion and chemical resistance; max cont. serv. temp 3000 F; dielectric str, 535 volts per mil; ts. 5900 psi; flexural str, 9280 psi; available in brown; shatterproof; sp gr, 1.7; opaque. Used for electrical insulation where arc resistance. heat resistance, dimensional stability and low water absorption are required.

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1077; melamine formaldehyde, thermosetting material; in granules for molding into parts. Has excellent resistance to solvents, etc.; max. cont. service temp. 210 F; dielectric strength 340 volts per mil: ts 7570 psi: flexural, 14,000 psi; low moisture absorption; translucent and opaque; shatterproof; sp gr number 1.49. Used for housings, lighting reflectors, etc.

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1500; melamine formaldehyde, thermosetting; furnished in granules for molding into parts. Has good chemical and arc resistance; flexural str, 10.600-11.800 psi (ASTM D650-42T); dielectric str. 365 volts per mil: ts, 6000 psi; impact str, 0.33 ft lb (Izod); available in brown; moisture absorption, low; sp gr. 1.45. Used for electrical insulation where arc resistance and trac resistance are required.

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3020; melamine formaldehyde, thermosetting; furnished in particles for compression or transfer molding. Has high chemical resistance; max cont. serv. temp. 240 F: flexural str, 14,000 psi; dielectric str. 270 volts per mil; impact str 0.68 ft lb (Izod); available in white, green, blue, red, brown, black and ivory; moisture absorption, low; sp gr, 1.4; opaque. Used for electrical insulation where arc resistance is required (plus shock resistance).

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MICARTA—Westinghouse Electric & Mfg. Co., Trafford, Pa. Phenolic base, thermosetting; furnished in laminated sheet, rods or tubes; for molding, machining or stamping into parts: also special molded shapes: dielectric strength, 30-700 volts per mil depending upon grade; low moisture absorption; resistant to shock corrosion: high polish: flexible; ts. 6000-16.000 psi: max cont. serv. temp. 212 F; nonflammable: sp gr. 1.30-1.7; depending upon grade. Used for bearings, gears, bushings, washers, thermal and electrical insulation and parts exposed to acids, alkalies and common solvents.

See advertisement, Page 152

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NEILLITE—The Watertown Mfg. Co., Watertown, Conn. Phenolic base, thermosetting material: furnished in powder form and granules for molding into parts: abrasion resistance, medium: resists corrosion caused by weak acid and alkali: dielectric str. 375-400 volts per mil: ts. 5500-7500 psi: comp str, 22 200-32 600 psi: moisture absorption, low; nonflammable: available in colors: shatterproof. For switch cases, spacers, gears, cams, knobs, etc.

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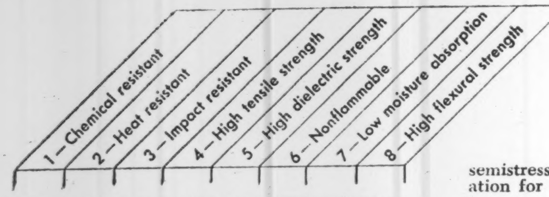
NITRON—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cellulose-nitrate: thermoplastic: furnished in sheets, rods and tubes, or in laminated form for machining, molding, stamping, swedging or blowing (steam);



into parts; corrosion-resistant; translucent; available in colors; flexible; dielectric str. 600-1200 volts per mil; ts, 5000-10,000 psi; low moisture absorption. Used for sight glasses, safety handles and structural models for strain study.

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NIXON C/A—Nixon Nitration Works, Nixon, N. J. Cellulose acetate, thermoplastic; furnished in sheets, rods, tubes and granules for injection and compression molding and extruding. Abrasion resistance, high; soluble in ketones and esters, slightly soluble in alcohol, little affected by hydrocarbons. Max cont. serv. temp, 160 F; flexural str, 4-15 000 psi (ASTM D 650-42T); dielectric str, 290-400 volts per mil; ts, 4-11,000 psi; comp str, 10-30,000 psi; impact str, 0.25-0.35 ft lb (Charpy), and 1.0-4.2 ft lb (Izod); available in colors; moisture absorption, low; sp gr. 1.27-1.56. For typewriter parts and machine housings.

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NIXON C/N—Nixon Nitration Works, Nixon, N. J. Cellulose nitrate, resinous thermoplastic; for molding, machining, stamping and forming into parts. Abrasion resistance, medium; resists corrosion caused by water, hydrocarbons, diluted alkalies and acids; heat resistant to 160 F; flexible; dielectric str, 300-500 volts per mil; ts, 6000-9000 psi; comp str, 20-30,000; moisture absorption, low; produced in color; shatterproof; sp gr, 1.39-1.45; transparent, translucent and opaque; machinability, good; Bhn, 8-11. For handles, knobs, nameplates, etc.

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NYLON—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Polyamide thermoplastic, furnished in flake for extrusion and coating, as monofilament for cutting up into parts and in powder for molding. Injection molded parts have high abrasion resistance; max cont. serv. temp, 380 F; flexural str, 13,000 psi (ASTM D 650-42T); dielectric str, 385 volts per mil; ts, 10,500 psi; comp str, 18,000 psi; impact str, 0.94 ft lb (Izod); produced in black, red and natural color; sp gr, 1.14; translucent and opaque. Used for valve seats, bearings, gears and coil forms.

See advertisements, Pages 272, 317

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OHMOID—Wilmington Fibre Specialty Co., Wilmington 99, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength, 200-700 volts per mil; moisture absorption, 2 per cent; insoluble in ordinary solvents; high polish; corrosion-resistant; ts, 10-14,000 psi; heat resistance, 250-300 F. Used for electric and mechanical insulation.

P

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PANELYTE—Panelyte Division, St. Regis Paper Co., New York. Laminated resinous thermosetting plastics in sheets, rods, tubes, structural forms and molded shapes; supplied in fabric, paper, wood or asbestos base grades; parts fabricated or semifabricated to print. Various grades characterized by high strength, light weight, good electrical properties, excellent heat resistance, and freedom from odor. Unaffected by solvents, dilute acids and alkalies. Outstanding machinability, punchability and dimensional stability. Used in aircraft for propellers and propeller parts, air deflectors for engines, skin, fairings, inter-compartment doors and for high "EI" molded flooring. Also for radio and other electrical insulation applications, gears, pinions and nonstressed or semistressed structural parts, and in refrigeration for trim and structural parts.

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PARAPLEX—The Resinous Products & Chemical Co., Philadelphia 5. A group of alkyd resins, tough, rubbery; thermoplastic.

X-100; can be vulcanized to give good tensile strength, elongation, resilience, oil resistance, low temperature flexibility; also can be molded, extruded or calendered. Defined as a vulcanizable resinous polyester, supplied as opaque slabs.

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PERMANITE—Maurice A. Knight Co., Akron 9, O. Furan resin; thermosetting; furnished in sheet, rods, tubes, or laminated form and in powder for molding, casting, machining, extruding and hand forming. Abrasion resistance, high; resists corrosion caused by acids, alkalies and salts; heat resistant to 360 F; flexibility, low; ts, 1000 psi; comp str, 50,000 psi; moisture absorption, very low; produced in black only; sp gr, 90-120 lb per cu ft; opaque; machinability, fair. Recommended for parts subject to corrosion by acids and other chemicals.

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PHENOL FIBRE—Penn Fibre & Specialty Co., Philadelphia. Phenolic base thermosetting material; furnished in sheets, laminated form, and in rods or tubes for machining and stamping into parts. Abrasion resistance, high; resists corrosion caused by air, water, oils, light forms of acids; heat resistant to 600 F; flexibility, low; dielectric str, 500 volts per mil; ts, 8-12,000 psi; comp str, 20-35,000 psi; moisture absorption, low; nonflammable; shatterproof, available in natural, brown and black; sp gr, 1.4; can be highly polished. For gears, bearings, washers, gaskets, special parts, insulation, pulleys, etc.

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PLASKON—Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo.

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Urea-formaldehyde, thermosetting material; furnished in powder and granules for compression and injection molding; abrasion resistance, high; resists corrosion caused by weak acids and alkalies; heat resistant to 170 F; flexural str, 10-16,000 psi (ASTM D 650-42T); dielectric str, 300-400 volts per mil; ts, 8000-13,000 psi; comp str, 25-35,000; impact str, 0.24-0.35 ft lb (Izod); moisture absorption, medium; available in colors; sp gr, 1.50±0.02; translucent. Used for housings, trim, knobs, dials, etc.

- 2 - - 5 - 7 -

Melamine-formaldehyde, thermosetting material; furnished in powder and granules for compression and transfer molding; abrasion resistance, high; resists corrosion caused by weak acids and alkalies; heat resistant to 210 F; dielectric str, 300-400 volts per mil; ts, 8000-13,000 psi; comp str 25-35,000; available in colors; sp gr, 1.50±0.02; translucent. For handles, dials, gage plates etc.

- - 3 4 5 - - -

PLASTACELE—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Cellulose-acetate base, thermoplastic; furnished in powder, sheets, rods and tubes for machining and molding into parts. Swaged and machined parts are affected only slightly by weak acids and alkalies; decomposed by strong acids and alkalies; soluble in acetone, acetates, etc. Max cont. serv. temp, 165-190 F at 66 psi; flexural str, 6-9000 psi (ASTM D 650-42T); dielectric str, 275-350 volts per mil; ts 2800-8000 psi; comp str, 4-7000 psi; impact str, 1.0-4.0 ft lb (Izod); available in colors; moisture absorption, medium; sp gr, 1.27-1.37; transparent, translucent and opaque. Used for oil gages.

See advertisements, Pages 272, 317

1 - - - 5 - 7 -

PLASTECH—Technical Plastics Co., Drexel Hill, Pa. Methyl methacrylate, thermoplastic; furnished in rods and sheets for blow molding. Chemical resistance, good; max cont. serv. temp, 150 F. For machine guards.

1 - - - 5 - 7 -

PLASTIKFLEX—R. D. Werner Co. Inc., New York. Flexible tubing, thermoplastic; to be extruded. Used for conduits, insulation, hose, fuel lines, hospital equipment, sleeving, spacers, stirrup pumps, gaskets, gages, (square tubing for dehydration), etc.

1 2 - - - 6 - -

PLASTROX "B"—Ingersoll Plastics Co., New York. Fibrous, thermosetting material, furnished in laminated sheet and powder form; for molding; abrasion resistance, medium; resists corrosion caused by oil; heat-resistant to 1700 F; flexibility, low; moisture absorption, medium; shatterproof; opaque. For pans, gaskets, washers, heat insulators, fluorescent light reflectors, etc.

1 - - - 5 - 7 -

PLAX POLYSTYRENE—Plax Corp., Hartford, Conn. Thermoplastic; furnished in sheets, rods or tubes for machining, stamping and machining into parts. Abrasion resistance, low; resists corrosion caused by acids, alkalies and alcohol, heat-resistant to 65 C; flexibility, low; dielectric str, 500-2500 volts per mil; ts, 5000-7000 psi, moisture absorption, low; sp gr, 1.04. For electronic and electrical insulators.

1 - - 4 - - - 8

PLEXIGLAS—Rohm & Haas Co., Philadelphia 5. Methyl-Methacrylate, thermoplastic; furnished in sheets, granules and powders for injection and compression molding and forming. Abrasion resistance, medium; chemical resistance, good; max cont. serv. temp, 140 F; flexural str, 13,000+ psi (ASTM D 650-42T); dielectric str, 400 volts per mil (0.125-in. thick material); ts, 6800 psi min; comp str, 13-15,000 psi impact str, unnotched 3-4 ft lb (Charpy); notched 0.35 ft lb (Izod); produced in colors; moisture absorption, medium; sp gr, 1.18; transparent and translucent; machinability, good. For guards, pump parts, dials, housings, etc.

See advertisements, Pages 308, 309

1 - - 4 5 - - -

PLYOPHEN—Reichhold Chemicals Inc., Detroit. Phenolic aldehyde, thermosetting. Furnished as liquid resins or varnishes; soluble in alcohol. For laminating, impregnating, bonding and casting; abrasion resistance, high; resists corrosion caused by nearly all chemicals except strong oxidizing acids and strong alkalies. Heat resistant to 275 F; flexibility, medium; dielectric str, 300-900 depending on the requirement; ts, 10-36,000 psi; comp str, 35,000 psi; moisture absorption, low; available in natural or black; shatterproof. For use where good mechanical properties are needed along with good dielectric strength, and corrosion resistance. One type used for bonding of wood under heat and pressure for plywood. Others are laminating varnishes used with paper, canvas, fiber glass, etc., to produce phenolic laminates, properties of which depend on the type of paper, etc., used. Tensile strength of 26,000 psi can be obtained for paper laminates; while with fiber glass, tensile strengths of 80,000 have been produced.

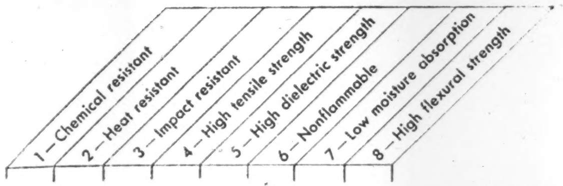
1 - - - 5 - 7 -

POLYFLEX—Plax Corp., Hartford, Conn. Polystyrene, thermoplastic; furnished in laminated sheets, for molding and machining into parts; abrasion resistance, medium; resists corrosion caused by acids, alkalies and alcohol; max cont. serv. temp, 170 F; flexibility, medium; dielectric str, 500-3500 volts per mil; ts, 7000-10,000 psi; moisture absorption, low; shatterproof; sp gr, 1.052; transparent; machinability, good. For electronic parts, covers, etc.

1 - 3 - - - 7 -

POLYTHENE—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Polyethylene, thermoplastic, supplied in sheets and in powder for molding. Injection or compression molded parts or extruded parts have low abrasion resistance; resist almost all chemical reagents at room temp. Very slowly attacked by concentrated nitric acid; attacked by certain aromatic, aliphatic or halogenated hydrocarbons. Max cont. serv. temp, 85-104 C; flexural str, 1500-1700 psi (ASTM D 650-42T); dielectric str, 460 volts per mil; impact str, 3 ft lb (Izod); available in colors; moisture absorption, low; sp gr, 0.92; translucent and opaque. For gaskets, packing, dampeners, etc.

See advertisements, Pages 272, 317



- - 3 - 5 - 7 -

PYRALIN—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Nitrocellulose base, thermoplastic; furnished in sheets, rods and tubes for machining into parts. Swaged, die-pressed and machined parts offer low abrasion resistance, are unaffected by weak acids, but decomposed by strong acids; gradually decomposed by alkalies and soluble in alcohols and esters. Max cont. serv. temp, 170-185 F at 66 psi; flexural str, 6000-15,000 psi (ASTM D 650-42T); dielectric str, 250-500 volts per mil; ts, 3-8000 psi; comp str, 20-30 000 psi; impact str, 5-9 ft lb (Izod); available in colors; moisture absorption, low; sp gr, 1.33-1.6; transparent translucent and opaque; good machinability. Used for handles, gage glasses, instrument covers, safety glass screens, etc.

See advertisements, Pages 272, 317

R

1 - - - 5 - 7 -

RESILON—The United States Stoneware Co., Akron, O. Resinous thermoplastic; furnished in sheets and lumps to be molded and cast into machine parts; corrosion-resistant; flexible; high dielectric strength. Used for lining parts to resist corrosive attack.

1 - - - - - 7 -

RESIMENE 803A—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Cellulose-filled melamine-formaldehyde type molding compound, specifically developed for molding electrical connector inserts. Combines excellent arc resistant characteristics of melamine compounds with ready moldability of phenolic general purpose materials. Formulated to meet Navy Spec. 17P4 (I.N.T.), Type CFG. Sp gr, 1.44-1.46; flexural str, 9000 psi; comp str, 32,700 psi.

- 2 - 4 - 6 - -

RESINOX—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Phenolic molding compounds, in standard and special formulas; thermosetting; heat-resistant; sp gr, 1.25-1.75; flexural str, 8000-15,000 psi; ts, 4200-8000 psi; impact str, 0.2-8.00 psi Izod test; water absorption, 0.01-0.6 (immersion 48 hours %). Used in electrical equipment, large housings, radio cabinets, etc. This tradename also refers to phenolic impregnating and treating resins.

1 - - - - - 7 -

RESIN X—Furane Plastics and Chemical Corporation, Los Angeles. Liquid furfural resin, adhesive and casting compound, for casting and bonding. Abrasion resistance, medium; resists corrosion caused by acids and solvents; heat resistant to 250 F; flexibility, low; dielectric str, 500 volts per mil; ts, 4000 psi; comp str, 12.000 psi; moisture absorption, low; produced in dark colors; sp gr, 1.27; opaque; machinability, good. For bonding of nonmetallic materials, etc.

- 2 - 4 - - - -

RESISTAL—Chemical Research Corp., Tulsa 1, Okla. High-strength plastic, having half the weight of aluminum, good electrical properties. Unaffected by all petroleum solvents, brines and acids and alkalies. Furnished in sheets 1/64 to 2 in. in thickness, in sizes 46 x 46 in., and 30 x 72 in.

RESPROID—Respro Inc., Cranston, R. I. Thermoplastic, furnished in extruded rods or tubes. For electrical insulation.

- 2 - - 5 - - -

REVOLITE—Atlas Powder Co., Zapon-Keratol Div., Stamford, Conn. Cloth base impregnated with Bakelite resin. Used for coated asbestos laundry roll covers for flat work ironers.

- 2 - - - 6 - -

ROSITE—Rostone Corp., Lafayette, Ind. Inorganic plastic for general molding purposes. Chemically a calcium aluminosilicate (with a microcrystalline grain structure) integrally reinforced with asbestos fiber. Compounded in moist powder form and forced into shape without heat under high pressure. Heat resistant to 900 F; comp str, 12-15,000 psi; excellent dimensional stability and arc resistance; machinability, good. For electrical applications, etc.

1 - - - - - - -

RS—Irvington Varnish & Insulator Co., Irvington, N. J. Radio spaghetti; braided cotton sleeving coated with a smooth, continuous, lacquer film; conforms to ASTM and VTA specifications for Grade B-2 flexible varnished tubing; highly resistant to aging; obtainable in five colors.

1 - 3 - - - 7 -

RYERTEX—Joseph T. Ryerson & Son Inc., Chicago 80. Phenolic type laminated plastic, furnished in sheets, strips, plates, rods or tubes, for molding and machining. Abrasion resistance, high; chemical resistance, high; max cont. serv. temp, 275 F; slow burning; flexibility, medium; ts, 11.000 psi; comp str, 40,000 psi; flexural str, 21,000 psi; moisture absorption, low; available in natural color; shatterproof; machinability, good. For heavy and light-duty bearings either water or oil lubricated. Also for abrasion and or chemical resistance applications.

See advertisement, Page 310

S

1 - - - - - - -

SAFLEX—Monsanto Chemical Co., Plastics Div., Springfield, Mass. Polyvinyl acetal thermoplastic sheet material, used as an interlayer in laminated safety glass; extremely tough from temperatures below zero to over 120 F.

- - - 4 - 6 7 -

SANDEE—Sandee Mfg. Co., 5050 Foster Ave., Chicago. Thermoplastics available in rods and tubes.

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K-4; vinyl base; heat resistant to 150 F; flexibility, high; ts, at 25 C, 1500 psi; moisture absorption low; available in color; sp gr, 1.22. For electrical insulation and for replacing rubber tubing and gaskets.

- - - 4 - - - -

T-2; cellulose acetate butyrate; in rods or tubes and custom shapes and sections; heat-resistant to 140 F; flexibility, low; dielectric str, 250-400 volts per mil; ts 2300-6700 psi; moisture absorption, low; available in color; shatterproof; sp gr, 1.15-1.24. For manometer tubes, refrigerator moldings, truck body moldings, etc.

- - - - 5 6 7 -

SARAN—The Dow Chemical Co., Midland, Mich., and licensees. Crystalline, thermoplastic, aliphatic chloride with polymeric base; furnished in special extruded and molded forms; material is corrosion-resistant; very tough and flexible; ts, to 50,000 psi (extruded); low moisture absorption; abrasion-resistant; takes high polish; high dielectric strength; shatterproof; nonflammable; available in color; transparent to opaque. Used for moldings, gaskets, packings, tubing, belting, etc. Licensees: Acadia Synthetic Products Div., Western Felt Works, Chicago; Allied Plastics Co., Los Angeles; American Hard Rubber Co., New York; Elmer E. Mills Co., Chicago; Extruded Plastics Inc., Norwalk, Conn.; Firestone Industrial Prods., Akron, O.; Hodgman Rubber Co., Framingham, Mass.; Irvington Varnish & Insulator Co., Irvington, N. J.; National Plastic Products Co., Baltimore; Parker Appliance Co., Cleveland; Pierce Plastics Inc., Bay City, Mich.; J. L. Skuttle Co., Detroit; St. Louis Plastic Molding, St. Louis; Standard Products Co., Detroit; Yardley Plastics Co., Columbus, O.

1 - - - 5 - 7 -

SPAULDITE—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes for machining or stamping into parts; dielectric str, 700 volts per mil; low moisture absorption; high polish; corrosion and heat-resistant (220 F); resistant to shock. Used for electrical insulation and where resistance to moisture and chemicals, appearance and permanence are essential.

- - - - 5 - 7 -

STYRALOY 22, 22-A—Dow Chemical Co., Midland, Mich. Synthetic elastometer furnished as molding powder. Excellent low temperature flexibility to -75 C; high dielectric strength; low power factor, high insulation resistance. Ts, 1000 psi; elongation at break 250 per cent; good abrasion resistance. Low moisture absorption. Dark blue, translucent. Used for wire coating, electrical insulation; can be extruded, injection or compression molded.

1 - - - - - 7 -

STYRON NA, LA, GA and CA—Dow Chemical Co., Midland, Mich. Thermoplastic; furnished in granules for molding; high clarity; corrosion-resistant; dielectric strength, 5000 volts per mil at 1 mil, 500 volts per mil at 125 mil; ts, ult, to 10,000 psi; low moisture absorption; low flammability; available in color; transparent. Used for insulators, decorative articles, structural parts, general injection molding, etc.

1 - - - 5 - 7 -

SURCO AMERICAN—Surprenant Electrical Insulation Co., Ben, Mass. Thermosetting; furnished in sheets, rods or tubes; for molding, stamping and extruding. Abrasion resistance as required; resists corrosion caused by acids and other corrosion elements; heat resistant to the degree required; flexibility as required; dielectric str, 1500 volts per mil avg; ts, 200-4500 psi; moisture absorption, low; available in 26 colors; shatterproof; sp gr, .90-1.45; opaque; machinability, good. For control cables, etc. in machine tools.

1 - 3 - - - 7 -

SYNFLEX—Industrial Synthetics Corp., Irvington. N. J. Rubber-like synthetics; polyvinyl chloride and polyvinyl copolymers; thermoplastic; in rods, tubes, shapes and tapes. Abrasion resistance, high; resists corrosion caused by weak and strong inorganic acids, sulphuric acids and alkalies; heat resistant to 230 F; flexibility, high; dielectric strength to 3600 volts per mil, ts, to 3600 psi; moisture absorption, low; shatterproof; sp gr, 1.18-1.48; transparent, translucent and opaque. Four outstanding compounds as well as special compounds for specific applications are available, such as window channel, mechanical rubber goods, electrical insulation, communications, etc.

1 - - - 5 - - -

SYNTHANE—Synthane Corp., Oaks, Pa. Phenolic, thermosetting materials, corrosion-resisting; furnished in sheets, rods and tubes, fabricated parts, and in parts made by molding the impregnated base materials. Available in following grades:

X; Kraft paper base, hard resin, laminated material; for mechanical applications where electrical requirements are of secondary importance; ts, 12,500 psi.

XP; Kraft paper base, plasticized resin, laminated material, primarily intended for punching; more flexible and not quite as strong as Grade X; moisture resistance and electrical properties intermediate between Grades X and XX.

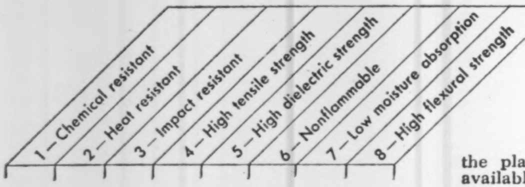
XX; cotton rag paper base laminated material; hard, greater percentage of resin than Grade X. Suitable for usual electrical applications; good machinability.

XXP; cotton rag paper base laminated material; similar to Grade XX in electrical and moisture-resisting properties, but more suitable for hot punching. Intermediate between Grades XP and XX in punching and cold flow characteristics.

XXX; cotton rag paper base laminated material; suitable for radio frequency work, for high humidity applications; minimum cold flow characteristics.

XXXP; cotton rag paper base laminated material; similar to Grade XXX but with lower dielectric losses and more suitable for hot punching; greater cold flow than Grade XXX, and intermediate between Grade XXP and XXX in punching characteristics.

C; heavy-weave fabric; base laminated material made throughout from cotton fabric weigh-



ing over 4 oz per sq yd, and having a count of not more than 72 threads per in. in the filler direction, nor more than 140 threads per in total in both warm and filler direction. Strong, tough material suitable for gears and other applications requiring high impact strength. Available in subgrades, depending upon sizes of gears and types of mechanical service. Should not be used for electrical applications.

CE; heavy weave fabric base laminated material, same as Grade C. For electrical applications requiring greater toughness than Grade XX, or mechanical applications requiring greater resistance to moisture than Grade C.

L; fine weave fabric base laminated material, of cotton; suitable for small gears and other fine machining applications, particularly in thickness under ½-in. Not quite as tough as Grade C: should not be used for electrical applications except for low voltage.

LE; fine weave fabric base laminated material, same as Grade L; for electrical applications requiring greater toughness than Grade XX; better machining properties and finer appearance than Grade CE. Also available in thinner sizes. Exceptionally good in moisture resistance.

T

- - - - 5 - - -
TAYLOR FIBRE—Taylor Fibre Co., Norristown, Pa. Phenolic base. thermosetting; furnished in laminated sheets, rods and strips for machining into parts. Abrasion resistance, medium and high; chemically resistant to most common solvents; max cont. serv. temp, 200 F; nonflammable; flexibility, high; dielectric str, 300 volts per mil; ts, 7500 psi; comp str, 25 000 psi; flexural str, 13 000 psi; available in red, gray, black and white; shatterproof: sp gr, 1.25; opaque; bhn, 25. Used for electrical insulation and wherever high arc resistance is required.

1 2 - - 5 - - -
TEFLON—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Polytetrafluorethylene, thermoplastic; furnished in sheets, rods, tubes and tapes; also for compression molding and extruding. Abrasion resistance, high; resistant to all chemicals including highly corrosive acids; max cont. serv. temp. 500-550 F; flexural str, 2000 psi (ASTM D650-42T); dielectric str, 480 volts per mil: ts, 2000-4500 psi; comp. str, 1700 psi; impact str. 4.0 ft lb (Izod); produced in light colors; moisture absorption, low; sp gr, 2.1-2.3; translucent and opaque; machinability, good. For gaskets, packings, bearings, gears, wire insulation, conduits, and tubing.

See advertisements, Pages 272, 317

- - 3 4 5 - - -
TEGIT—Garfield Mfg. Co., Garfield, N. J. Tan colored, cold-molded plastic: corrosion-resistant; high dielectric strength; moisture absorption less than 1 per cent; heat resistance, 300 F: impact-resistant; resists hot oil, boiling water and ordinary chemicals; will not shrink, crack, warp or deteriorate with age. Used for heavy-duty wiring devices and small insulated parts.

- - 3 - - - 7 -
TENITE—Tennessee Eastman Corp., Kingsport, Tenn.

I; cellulose-acetate base, thermoplastic; furnished in granular, pellet and molding sheet form; available in clear transparent and colors, plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding decorative and industrial products, also extruded in form of strips, rods and tubes.

II; cellulose-acetate butyrate base, thermoplastic: furnished in granular, pellet and molding sheet form: has greater dimensional stability than cellulose acetate plastic because of lower moisture absorption: contains less plasticizer than cellulose acetate plastic and the plasticizer used has greater retentivity; available in clear transparent and colors; plain, variegated, translucent and opaque; high impact strength; high polish. Used for compression and injection molding of decorative and industrial products, also extruded in form of strips, rods and tubes.

1 2 3 4 - - - -
TEXTOLITE—General Electric Co., Plastics Division, Pittsfield, Mass. Phenolic, urea-cellulose bases, thermosetting and thermoplastic materials; compression, injection and transfer molded, laminated, molded laminated, sheets, rods, tubes, bearings, fabricated parts; abrasion and corrosion resistant; ts, 3500-20,000 psi; dielectric str, 60-1000 volts per mil; heat resistant to 140-150 F; resistant to shock; flexible in some grades; available in color; takes high polish; translucent in some grades; sp gr, 1.07-2.03. Used for electrical or thermal insulation, structural parts, gears, cams, bearings, housings, knobs, etc.

1 2 - 4 - - - -
Cold Molded—Two types; nonrefractory material containing asphalt as a binder and asbestos as a filler and refractory containing cement and drying oils as a binder with an asbestos filler; cold molded at room temperatures and heat treated for strength and toughness; corrosion-resistant; heat and arc-resistant. Not recommended for parts requiring high electric strength or thin sections.

See advertisement, Page 303

1 - - - - 6 7 -
TEXRUB—M. B. Price Associates, New York. Rubber-like, vinyl base, thermosetting and thermoplastic materials, furnished in laminated sheets, rods or tubes; for molding, casting, machining, stamping and extruding into parts; abrasion resistance, high; resist corrosion caused by water, gas, oils, alkalies, uric acid and 30 per cent sulphuric acid and ozone; soften at 240 F; melt at 330; flexibility, good: ts, 2500 psi. Available in black, white, gray, red, brown and green; translucent and opaque; shatterproof; sp gr, 1.26. Used for chemical tubing and piping, etc.

1 - - - 5 - - 8
TRANSFLEX—Irvington Varnish & Insulator Co., Irvington, N. J. Polyvinyl chloride, thermoplastic; furnished in tubing and rods for extruding. When used as conduit permits quick identification of coded enclosed leads and location of wire breaks; unusual elongation facilitates stretching over lugs, splices and other projections; does not become brittle at temperatures as low as −58 F; max cont. serv. temp. 170 F; ts, 3000 psi; dielectric str, 1200 volts per mil (dry): 1000 volts per mil (wet)—for tubing wall thickness approximately 0.020-in.; sp gr, 1.2; moisture absorption, low. Designed for moderately low temperature applications; wire insulation, conduit, etc.

- - - - 5 6 - -
TULOX—Extruded Plastics Inc., Norwalk, Conn.

A; cellulose acetate thermoplastic: furnished in tubing to full range of brilliant colors transparent, translucent and opaque; odorless and tasteless. More rigid than EC and TT types. Heat resistant to 160 F; ts, 4-6000 psi; sp gr, 12.8.

EC: ethyl cellulose thermoplastic, rigid; furnished in tubes; medium abrasion resistance; high impact strength at low temperature; transparent colors, translucent, opaque, no crystal clear. Tubular parts for use where high impact strength is required over a range of −40 F to 150 F.

TT; cellulose acetate thermoplastic, furnished in extruded rods or tubes in sizes from 0.100-2 in. OD: abrasion resistance, medium; heat resistant to 160 F: flexibility, low; ts, 4-5000 psi: moisture absorption, low: available in color: sp gr, 1.2: shatterproof; transparent: translucent: opaque: machinability, good. For use as gage glasses, separators and small machine parts produced on screw machine, etc.

1 - - - 5 - 7 -
TYGON—The United States Stoneware Co., Akron, O. Synthetic resin, thermoplastic; furnished in flexible or rigid sheets, tubing, rods, or in liquid form; may be molded cast or extruded. Abrasion, impact and corrosion-resistant; unaffected by oil, gasoline, water; nonaging; high dielectric and tensile strength. May be transparent, translucent or opaque; available in colors. Nontoxic. For molded machine parts, gaskets, tubing, etc.

V

1 - 3 4 - 6 7 -
VALITE—Valite Corp., Lockport, La.

1 - 3 - - - 7 -
No. 8123, laminating resin; thermosetting; for impregnating duck, paper, etc. For housings, silent gears, mountings, electrical parts, switches, etc.

See advertisement, Page 312

1 - - - - - 7 -
VIBRIN Resins—Naugatuck Chemical Div., U. S. Rubber Products Inc., New York. Polyester thermosetting material; furnished in liquid form, for casting and laminating. Available in different grades. Grade 103 has medium abrasion resistance and excellent chemical resistance; flexural strength of 17,000 psi; dielectric str, 2000 volts per mil (0.005-in. sample); ts, 10,000 psi; impact str, 10.3 ft-lb (Izod); from pale yellow to colorless, transparent; moisture absorption, low; sp gr, 1.16. For knobs, covers, etc., and laminated structures of light weight, high strength and decorative appeal.

1 2 - - - - 7 -
VIMLITE—Celanese Plastics Corp., New York 16. Wire or plastic mesh re-enforced plastic. Bursting strength (Mullen), wire 200 psi; plastic 125-165 psi; visible light transmission, wire, 57 per cent, plastic up to 80 per cent; tough, translucent. While both are flexible, plastic mesh handles almost like fabric. Both are lightweight, will not support combustion. Used for machine guards, etc.

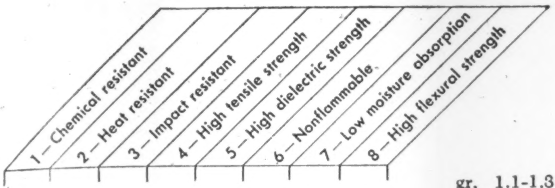
1 - - - - 6 7 -
VINYLITE—Bakelite Corp., New York 17. Thermoplastic vinyl resins: material available as rigid sheets, flexible sheeting, flexible film, rigid and elastomeric molding and extrusion compounds, surface coatings, cloth coatings, textile treatments, adhesives and monofilaments. Can be formed, drawn, laminated, and bonded under moderate heat and pressure. In their basic form, they are odorless, tasteless, nontoxic, and range from nonflammable to slow burning. Some of them have exceptional resistance to moisture and most chemicals. They are strong and tough even at lower-than-freezing temperatures. They do not warp and have unusual dimensional stability.

Vinyl chloride-acetate resins both elastomeric and rigid products in many forms; vinyl acetate resins, adhesives and textile treatments; vinyl butyral resins, safety glass and cloth coatings; vinyl chloride resins, molding and extrusion compounds.

See advertisement ,Page 300, 311

1 - - - 5 - 7 -
VISTANEX—Stanco Distributors Inc., New York 4. Non vulcanizing plastics, isobutylene polymer base material; furnished in sheets; for molding or extruding: abrasion resistance, medium; resists corrosion caused by acids, alkalies and oxidation; flexibility, low; dielectric constant, 2.2 at 1000 cycles; ts, 1500 psi; moisture absorption, low; sp gr, 0.91: translucent: machinability, poor; for electrical insulation, etc.

1 - - - 5 - - 8
VOLTRON—Industrial Synthetics Corp., Irvington 11, N. J. Polyvinyl chloride base thermoplastic: furnished in strips, rods or tubes; for extruding. Abrasion resistance, high; chemical resistance, high to all inorganic acids and most other chemicals except ketones, esters, aromatic and chlorinated hydrocarbons; max cont. serv. temp. 158-194 F: self-extinguishing: flexibility, high; dielectric str, 1-2000 volts per mil; ts, 1900-3000 psi (varying with different grades): elongation, 330-435: moisture absorption, low; available in clear, white, black, yellow, red, blue and green: transparent, translucent and opaque; sp gr, 1.19-



1.25; shatter-proof. For electrical insulation.

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VULCOID — Continental-Diamond Fibre Co., Newark, Del. Aniline formaldehyde and cellulose hydrate base thermoplastics; furnished in sheets, rods and tubes for forming into parts. Abrasion resistance, high; max cont. serv. temp, 230 F; flexural str, 23,000 psi (ASTM D-229-42); dielectric str 450 volts per mil; ts, 12.000 psi; comp str 36.000 psi; impact str. 5.0 ft lb (Izod); available in dark tan; moisture absorption, low; sp gr, 1.1-1.35; opaque; good machinability. For electrical insulation.

W

1 - - - - - 7 -

WYNITE—The National Plastic Products Co., Odenton, Md. Thermoplastic, nontoxic resin. When extruded offers lightness, flexibility, and resistance to moisture and chemicals. Available in neutral translucent, also red, brown, tan, navy royal blue, yellow, kelly green, nile green, black and white. Suitable for electrical insulation and as a protective coating for wires of all types.

X

- - 3 - 5 - - -

X-CREPE Resin—Cincinnati Industries Inc., Cincinnati 15. Phenol formaldehyde, thermosetting; furnished in rolls, sheeted, die cut and coiled; also preforms for compression molding and laminating. Abrasion resistance, medium, resists action of mild acid and alkaline solutions; flexural str, 13.000-15,000 psi (ASTM D-650-42T); dielectric str, 300-400 volts per mil; ts 9200-12.000; str, 23.000 38.000 psi; impact str, 1.0-4.5 ft lb (Izod); available in black, brown and dark colors; sp gr 1.45; opaque; machinability, fair. For structural or functional parts where properties of phenolics are desirable.

Index of Plastics by Type

SUPPLEMENTING the alphabetical listing by tradenames which will be found commencing on Page 207, this index has been compiled to aid the designer in the selection of plastic materials where either the tradenames are not known or it is desired to compare the properties of similar materials. Such properties are given in the alphabetical listing mentioned above.

THERMOSETTING

Aniline formaldehyde

Formica
Vulcoid

Melamine formaldehyde

Melmac
Plaskon
Resimene

Phenolic

Bakelite
Catalin
Celoron
Co-ro-lite
Dilecto
Durez
Durite
Farlite
FD
Formalin
Formica
Indur
Insurok
Ivoricast
Kys-ite
Lamicoid
Lamitex
Makalot
Mecoboard
Micarta
Neillite
Ohmoid
Panelyte
Phenol Fibre
Plyophen
Resinox
Ryertex
Spauldite
Synthane
Taylor
Textolite
Valite
X-Crepe

Urea

Beetle
Farlite
Insurok
Lamicoid
Makalot
Plaskon
Textolite

Vinyl

Clearseal
Texrub

Cold molded

Ebrok
Garit
Gummon
Hemit
Tegit
Textolite

Other types

Cottonleather
FV
Hiden
Irvington
Irv-o-slot
Laminac
Lamineer
Permanite
Plastrox "B"
Resin X
Resistal
Revolite
Rosite
RS
Surco American
Vibrin

THERMOPLASTIC

Acrylic butyrate

Gemlite

Aniline formaldehyde

Cibanite
Dilectene

Casein

Ameroid

Cellulose acetate

Bakelite
Chemaco
Durashield
Fibestos
Gemloid
Inceloid
Lumarith
Nixon C/A
Nixonite
Plastacele
Sandee
Tenite
Textolite
Tulox

Cellulose hydrate

Diamond Fibre
Vulcoid

Cellulose nitrate

Celluloid
Nixon C/N
Pyralin
Textolite

Ethyl cellulose

Celcon
Cel-o-glass
Chemaco
Ethocel
Tulox

Methyl methacrylate

Lucite
Plastech
Plexiglas

Polyamide

Nylon

Polybutene

Bakelite
Vistanex

Polyethylene

Bakelite
Polythene

Polymeric

Saran

Polystyrene

Bakelite
Chemaco
Loalin
Plax
Polyflex

Polyvinyl acetal

Saflex

Polyvinyl alcohol

Compar
Elvanol

Polyvinyl butyral

Butacite
Vinylite

Styrene

Bakelite
Lustron
Styron

Vinyl

Chemaco
Clearseal
Elasti-glass
Elastron
Elvacet
Fibron
Gemflex
Sandee
Synflex
Texrub
Transflex
Tygon
Vinylite
Voltron

Other types

Cel-o-glass
Cerex
Duralon
Forticel
Geon
Hyflex
Insurok
Irv-o-lite
Ivi-flex
Kem-pol
Kriston
Meadol
Paraplex
Plastikflex
Resilon
Resproid
Styraloy
Teflon
Vimlite
Wynite

Producers of Plastics

A

American Cyanamid Co., Plastics Div., 30 Rockefeller Plaza, New York 20.
Urea-formaldehyde plastic—BEETLE
Melamine-formaldehyde plastics—MELMAC
Unsaturated polyester resin—LAMINAC

American Plastics Corp., 225 W. 34th St., New York 1.
Casein thermoplastic—AMEROID

American Products Mfg. Co., Oleander and Dublin Sts., New Orleans.
Cellulose derivative—INCELOID

Atlas Powder Co., Zapon-Keratol Div., Stamford, Conn.
Cloth calendered with Bakelite resin—REVOLITE

B

Bakelite Corp., 30 E. 42nd St., New York.
Phenolic, urea, cast resin plastics, and polystyrene plastics—BAKELITE
Vinyl chloride-acetate, vinyl acetate and vinyl butyral resins and plastics—VINYLITE
See advertisements, Pages 300, 311

Buchsbaum & Co., S., 1737 S. Michigan, Chicago 16.
Vinylidene chloride and vinyl chloride acetate copolymers—ELASTI-GLASS

C

Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York 17.
Thermoplastic materials—CARBIDE Polyethylene

Catalin Corp., 1 Park Ave., New York.
Phenolic plastics—CATALIN
Styrene plastics—LOALIN

Celanese Plastics Corp., 180 Madison Ave., New York 16.
Cellulose acetate plastic—LUMARITH
Cellulose acetate (transparent sheet)—LUMARITH
Cellulose nitrate plastic—CELLULOID
Cellulose propionate thermoplastic—FORTICEL
Ethyl-cellulose thermoplastic—CELCON
Wire or mesh plastic—VIMLITE

Chemaco Corp., Berkeley Heights, N. J.
Cellulose-acetate, ethyl-cellulose, polystyrene and vinyl compound materials—CHEMACO

Chemical Research Corp., P. O. Box No. 2002, Tulsa 1, Okla.
High-strength plastic—RESISTAL

Ciba Products Corp., 77-79 River St., Hoboken, N. J.
Aniline-formaldehyde resin—CIBANITE

Cincinnati Industries Inc., 515 Station Ave., Lockland, Cincinnati.
Phenol formaldehyde thermosetting plastic—X-CREPE Resin

Cleaveland Laboratories & Mfg. Co. Inc., Holland Ave., Peapack, N. J.
Vinyl resin coatings—CLEARSEAL

Columbian Rope Co., Auburn, N. Y.
Phenolic resin base—CO-RO-LITE

Continental-Diamond Fibre Co., Newark, Del.
Phenolic plastic — DILECTO CELORON, MECOBOARD and DILECTO Glass Fabric
Resinous plastic—VULCOID
Vulcanized fibre—DIAMOND FIBRE
Insulating material—DILECTENE

D

Dow Chemical Co., Midland, Mich.
Plastic granules—ETHOCEL
Thermoplastic—STYRON and SARAN
Elastomer—STYRALOY

Du Pont de Nemours, E. I., & Co. Inc., Wilmington 98, Del.
Plastic coated wire mesh—CEL-O-GLASS
Nitrocellulose base—PYRALIN
Polymethyl-methacrylate base—LUCITE
Cellulose acetate base—PLASTACELE
Polyvinyl alcohol—ELVANOL
Thermoplastic—NYLON and POLYTHENE
Polyvinyl acetate—ELVACET
Polytetrafluoroethylene—TEFLON
Polyvinyl butyral—BUTACITE
See advertisements, Pages 272, 317

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.
Phenolic plastic—DUREZ

Durite Plastics Inc., 5000 Summerdale Ave., Philadelphia 24.
Phenol-formaldehyde and phenol-furfural plastics—DURITE

E

Extruded Plastics Inc., Norwalk, Conn.
Thermoplastic tubing—TULOX

F

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Phenolic and urea plastic—FARLITE
Fabric base, thermosetting plastic—FARLITE Gear Stock
Abrasive surface, phenol-formaldehyde—FARLITE Safety Treads

Formica Insulation Co., 4613 Spring Grove Ave., Cincinnati.
Laminated resinous plastic—FORMICA
See advertisement, Page 270

Franklin Fibre-Lamitex Corp., 190 E. 12th St., Wilmington, Del.
Laminated phenolic—LAMITEX

Furane Plastics & Chemicals Corp., 4500 Brazil St., Los Angeles.
Liquid furfural resin—RESIN X

G

Garfield Mfg. Co., Garfield, N. J.
Thermosetting materials—GUMMON (black); HEMIT (gray-white); TEGIT (phenolic binder) and GARIT

Gemloid Corp., 7900 Albion Ave., Elmhurst, L. I., N. Y.
Tubing and gasketing material—GEMFLEX
Thermoplastic material—GEMLOID
Acrylic butyrate, thermoplastic—GEMLITE

General Electric Co., 1 Plastics Ave., Pittsfield, Mass.
Phenolic, urea cellulose thermosetting and thermoplastic materials—TEXTOLITE
See advertisement, Page 303

General Plastics Corp., 119 W. 57th St., New York 19.
Laminated plastics—LAMINEER

Goodrich Chemical Co., B. F., Rose Bldg., Cleveland.
Allyl ester, thermosetting material—KRISTON "A"
Polyvinyl chloride thermoplastic—GEON
See advertisement, Page 142

H

Hodgman Rubber Co., Farmingham, Mass.
Thermoplastic—SARAN

I

Industrial Synthetics Corp., Irvington, N. J.
Rubber-like synthetics—SYNFLEX, ELASTRON and VOLTRON

Ingersoll Plastics Co., 11 West 42nd St., New York.
Fibrous, thermosetting material—PLASTRON "B"

Interlake Chemical Corp., Union Commerce Bldg., Cleveland 14.
Phenolic molding compounds—MAKALOT
Thermosetting liquid phenolics—FD RESINS
Impregnating resin—INTERLAKE Resin 4585

Irvington Varnish & Insulator Co., Irvington, N. J.
Flexible extruded plastic tubing—HYFLEX, IRV-O-LITE XTE 30, IVI-FLEX and TRANSFLEX
Flexible varnished tubing — IRV-O-VOLT, RS and FV
Insulating paints, enamels—IRVINGTON
Insulating punchings—IRVINGTON
Transformer lead tubing—IRVINGTON
Varnished fabrics and papers—IRVINGTON
Varnished slot insulation—IRV-O-SLOT
Plastic and varnished wire markers—IRVINGTON
Plastic insulating tape and tubing—FIBRON
Lacquered tubing—FV
Braided sleeving cotton—RS

K

Keyes Fibre Co., Waterville, Me.
Phenolic fiber base—KYS-ITE K-100

Knight, Maurice A., Co., 175 Kelly Ave., Akron 9, O.
Resinous thermoplastic—PERMANITE

M

Mead Corporation, The, Chillicothe, O.
Lignin thermoplastic—MEADOL

Mica Insulator Co., 200 Varick St., New York.
Phenolic and urea-base plastic—LAMICOID

Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Cellulose nitrate plastic—NITRON
Cellulose acetate—FIBESTOS
Phenolic plastic—RESINOX
Polyvinyl acetal plastic—SAFLEX
Polystyrene, thermoplastic—LUSTRON
High heat-resistant thermoplastic — CEREX
Cellulose filled melamine - formaldehyde — RESIMENE 803A

N

National Plastic Products Co., 6527 Russell St., Detroit.
Liquid casting resin—FORMALIN

National Plastic Products Co., Odenton, Md.
Nontoxic resin—WYNITE

Naugatuck Chemical Div., U. S. Rubber Products Inc., 1236 Sixth Ave., New York.
Polyester thermosetting material—VIBRIN Resins

Nixon Nitration Works, Nixon, N. J.
Cellulose acetates—NIXON C/A
Cellulose nitrate—NIXON C/N

P

Panelyte Div., St. Regis Paper Co., 230 Park Ave., New York.
Laminated resinous thermosetting material—PANELYTE

Parkwood Corp., 24 Water St., Wakefield, Mass.
Laminated plastic—HIDEN

Penn Fibre & Specialty Co., 2024-2030 E. Westmoreland St., Philadelphia 34.
Phenolic base, thermosetting material — PHENOL FIBRE

Plastic Fabricators Inc., 440 Sansome St., San Francisco 11.
Cellulose acetate thermoplastic — DURA-SHIELD

Plaskon Division, Libbey-Owens-Ford Glass Co., 2112 Sylvan Ave., Toledo, O.
Thermosetting plastics—PLASKON

Plax Corp., 133 Walnut St., Hartford 1, Conn.
Thermoplastic materials—PLAX Polystyrene and POLYFLEX

Price Associates, M. B., 350 Fifth Ave., New York.
Rubber-like, vinyl base plastic—TEXRUB

R

Reichhold Chemicals Inc., 601 Woodward Heights Blvd., Detroit 20.
Thermosetting material—PLYOPHEN

Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis.
Phenolic plastic—INDUR and INDUR VARNISH

Resinous Products & Chemical Co., 222 West Washington Sq., Philadelphia 5.
Vulcanizable resinous polyester—PARAPLEX

Resistoflex Corp., Belleville, N. J.
Modified polyvinyl alcohol base—COMPAR

Respro Inc., Wellington Ave., Cranston 10, R. I.
Thermoplastic—RESPROID

Richardson Co., The, Melrose Park, Ill.
Thermosetting, thermoplastic and translucent plastics—INSUROK
Acid-resisting bituminous plastic—EBROK
See advertisement, Page 162

Rohm & Haas Co. Inc., 222 W. Washington Sq., Philadelphia 5.
Acrylic base plastic—PLEXIGLAS
See advertisements, Pages 308, 309

Rostone Corp., 125 Earl Ave., Lafayette, Ind.
Inorganic plastic—ROSITE

Ryerson & Son Inc., Jos. T., 16th and Rockwell Sts., Chicago.
Bearing material—RYERTEX
See advertisement, Page 310

S

Sandee Mfg. Co., 5050 Foster Ave., Chicago.
Thermoplastics—SANDEE

Sherwin-Williams Co., The, 101 Prospect Ave., N. W., Cleveland.
Vulcanizable polymer derived from vegetable oils—KEM-POL

Southern Friction Materials Co., Charlotte, N. C.
Cotton fabric base with resinous impregnation—COTTONLEATHER

Spaulding Fibre Co. Inc., Tonawanda, N. Y.
Phenolic plastic—SPAULDITE

Stanco Distributors Inc., 26 Broadway, New York 4.
Nonvulcanizing plastic—VISTANEX

Surprenant Electrical Insulation Co., Ben, Mass.
Thermosetting material—SURCO AMERICAN

Synthane Corp., Oaks, Pa.
Laminated Bakelite—SYNTHANE

T

Taylor Fibre Co., Norristown, Pa.
Phenolic base thermosetting material—TAYLOR FIBRE

Technical Plastics Co., 630 Aronimink Place, Drexel Hill, Pa.
Methyl methacrylate—PLASTECH

Tennessee Eastman Corp., Kingsport, Tenn.
Cellulose ester plastics—TENITE

U

United States Stoneware Co., Akron, O.
Resinous thermoplastic—RESILON
Synthetic resins—TYGON
Resinous thermosetting—DURALON

V

Valite Corp., Lockport, La.
Thermosetting materials—VALITE
See advertisement, Page 312

W

Watertown Mfg. Co., Watertown, Conn.
Phenolic, thermosetting material—NEILITE

Werner Co. Inc., R. D., 380 Second Ave., New York.
Thermoplastic, flexible tubing — PLASTIKFLEX

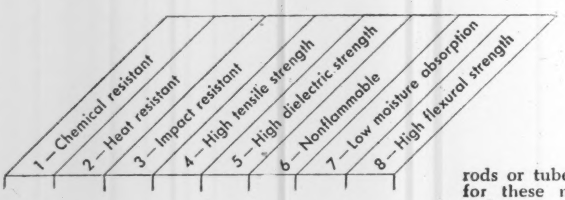
West Coast Plastics Enterprises, No. 67, 4891 Huntington Drive, Los Angeles 32.
Phenol formaldehyde thermosetting materials —IVORICAST

Westinghouse Electric & Mfg. Co., Trafford, Pa.
Phenolic plastic—MICARTA
See advertisement, Page 152

Wilmington Fibre Specialty Co., Wilmington, Del.
Phenolic plastic—OHMOID

Nonmetallics Listed by Tradenames

(For listings by producing companies, and complete street addresses, see Page 226. For index of nonmetollics by type, see Page 225)



A

- - 3 - - - - -
ACADIA—Acadia Synthetic Products, Division of Western Felt Works, Chicago. Synthetic rubber compounds to meet Army, Navy and AMS specifications in sheets, extrusions and molded parts.

See advertisement, Page 144

1 2 - - 5 - 7 -
ACE—American Hard Rubber Co., New York.

1 - - - 5 - 7 -
Hard rubber; thermosetting; furnished in sheets, rods or tubes and molded parts; may be machined, molded or extruded into parts; moisture absorption, low; abrasion resistance, medium; chemical resistance, excellent in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, medium; ts, 5-9000 psi; comp str, 12,000 psi; dielectric str, 475 volts per mil; flexural str, 15,000 psi; elongation, 3-6 per cent; color range limited; high shock resistance; opaque; sp gr, 1.18-1.2; rockwell HR 95.

- 2 - - 5 - 7 -
Heat-resistant hard rubber; furnished in sheets, rods or tubes and molded parts, for molding, extruding and machining; abrasion resistance, medium; chemical resistance, excellent in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, low; dielectric str, 400 volts per mil; ts, 5-6500 psi; comp str, 10,000 psi; flexural str, 8-10,000 psi; elongation, 1-3 per cent; moisture absorption, low; color range limited; opaque; sp gr, 1.65-1.8; medium shock resistance; machinability, fair. Both used for handles, caster wheels and special molded parts.

1 - 3 - - - - -
AEROLITE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated thin, window glass with Vinal plastic binder, furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 160 F; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; highly polished. For windows where low weight is important.

1 - - - - - - 8
AERTITE—Johns-Manville, New York 16. Rubbery, asphaltic-asbestos base; furnished in soft plastic form; corrosion-resistant. Used on mechanical equipment to prevent air infiltration.

1 2 - - - - - 8
AJAX—Hewitt Rubber of Buffalo, Div. Hewitt-Robins Inc., Buffalo 5. Rubber for hose, belting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

1 - - - 5 - 7 -
ALLYMER—Pittsburgh Plate Glass Co., Columbia Chemical Div., Barberton, O. A complete line of allyl resin monomers formerly known as Columbia resins and designated as C. R. 39 etc. The numbers such as 39 and 149 continue to designate types. Various compounds such as Fiberglas base and allyl resin, allyl alcohol base resin, paper-base and allyl resin, cotton-cloth and allyl resin, for both C.R. 39 and C.R. 149 types are available. Thermosetting; furnished in sheets, rods or tubes and laminated form. Properties for these materials include corrosion, heat and impact resistance, high tensile strength and low moisture absorption.

1 2 3 - - - - -
AlSiMag—American Lava Corp., Chattanooga, Tenn. Steatite ceramic of alumina, silica and magnesia. By mixing various proportions, different grades are created, each with special chemical, electrical and physical properties.

1 - - - - - - -
192; takes a hard, high polish making it suitable for textile thread guides; resists all chemical action except that of hydrofluoric acid; abrasion resistance, high.

- 2 - - - - - -
197; possesses high mechanical strength combined with low electrical losses at high frequencies for use in electronic heating device field.

A196 and A35; possess high mechanical strength combined with low electrical losses at high frequencies; for use in most electrical and electronic applications.

- - 3 - - - - -
202 and 72; used in combustion tips and for thermocouple insulators since they have low coefficients of expansion and can withstand thermal shock.

222; a special ceramic; machinable.

1 - - - - - 7 -
AMBERLITE—Resinous Products & Chemical Co., Philadelphia 5. Phenolic resin adhesive; furnished in powder form; has low moisture absorption, high density. Used in manufacture of waterproof plywood for aircraft and marine use.

- - 3 - - - - -
AMERICAN FELT—American Felt Co., Glenville, Conn. Felt material furnished in sheet, rods or tubes; for machining, stamping and extruding into parts. Abrasion resistance for certain felts is low, while for others high; resists corrosion caused by neutral conditions; heat-resistant to 250 F; flexibility, low, medium or high (as specified); moisture absorption also as specified; produced in any color. For oil retaining, dust excluding, filtering and vibration dampening.

1 - - 4 - - - -
AMERICAN PLYWOOD—American Plywood Corp., New London, Wis. Phenolic urea plywood; furnished in sheet and laminated form; for machining into parts. Abrasion resistance medium; heat resistant to 300 F; flexibility, high; ts, 12,000 psi; moisture absorption, medium; inflammable; shatterproof; opaque; can be highly polished.

1 2 - - - - - -
AMERIPOL—The B. F. Goodrich Co., Akron, O. Oil-resisting and heat-resisting synthetic rubber; compounded and vulcanized to give wide range of properties. Ts, approx 4000 psi. In uncompounded form, has specific gravity of 1. Used for grease seals, packing rings, grommets and washers.

- - 3 4 - - - -
ARMORPLY—United States Plywood Corp., 55 West 44 St., New York 18. Plywood, metal-covered; furnished in sheet form; has high strength and low weight. For use in food machinery, laboratories, etc.

1 - - - - - - -
ARMSTRONG'S—Armstrong Cork Co., Lancaster, Pa. Compositions of cork and Neoprene, Buna N, Buna S, Thiokol, and butyl rubber. More than two dozen materials having a wide range of physical properties; furnished in roll, sheet, cut gasket, molded, and extruded forms. Impervious to liquids and gases; highly resistant to deterioration by oils, solvents and most other liquids, gases, corona and weather; high and low coefficients of friction, high and low degrees of compressibility, lateral flow, etc.; available with or without fabric backing, with or without adhesive coating. Furnished to meet specific requirements. Used as gaskets, packings, washers, valve disks, feed rolls, polishing wheels, diaphragms, friction and vibration pads, etc.

Compositions of cork and natural rubber, for specific applications not requiring the special characteristics of synthetic rubber.

Synthetic rubber compounds for applications where requirements include properties such as resistance to oil, aromatic fuel, solvents, sunlight or electrical corona—and where lateral flow is necessary or not objectionable.

Straight cork compositions, ranging in density from 8 lb to 36 lb per cu ft, in compressibility from 5 to 60 per cent, in tensile strength from 60 to 450 psi.

Fibrated leather and other fiber sheet packings including noncorrosive materials, for general gasketing.

Rag felt papers for vibration damping, space packing, anti-squeak lining and use as gaskets, dust seals, etc.

See advertisement, Page 135

1 - - - - - 7 -
AZTEC Asbestos Packing—Gatke Corp., Chicago 1. Packing for high-pressure valve stems, rods and other machine elements; furnished in compressed sheet, oilproof plastic, twisted and braided stock and wire interwoven sheet.

B

- 2 - - - - - -
B&W Firebrick—The Babcock & Wilcox Co., Refractories Div., New York 6. Ceramics furnished in standard or special refractory shapes; fabricated by molding and kiln firing.

Junior Firebrick; serv. temp, 2925 F; fusion point 3173 F; conductivity, Btu/sq ft/hr/d F/in. at mean temp of 1600 F, 11.50; hi melting point; high creep strength; and lo volume change at elevated temperatures.

80 Firebrick; serv. temp. 3000 F; fusion point, 3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1600 F, 12.75; has high melting point, high creep strength; and low volume change at elevated temperatures.

Insulating Firebrick; furnished in various grades, ranging in serv. temp from 1600-2900; fusion points from 2700-3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1500 F, 1.24-3.15; cold crushing strength, 48-308 psi; modulus of rupture, 41-283 psi. All have high resistance to heat flow; are lightweight, and have low heat storage.

All are used for linings in all types of furnaces for industries such as ceramics, gas generators, chemicals, oil refining, power, steel, producing and processing, etc.

1 - - - - 6 - 8
BLUE RIDGE Rolled Figured and Wire Glass—Blue Ridge Div., Libbey-Owens-Ford Glass Co., Toledo, O. Glass furnished in sheet form for cutting and bending into parts; abrasion resistance, high; resists corrosion caused by everything except hydrofluoric

1—Chemical resistant
2—Heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Low moisture absorption
8—High flexural strength

acid; heat resistant to 130-154 F; flexibility, low; dielectric str, 10 kv per mil; ts, 6500 psi; comp str, 36,000 lb per one-in. cube; moisture absorption, low; nonflammable; available in color; sp gr, 2.5; in transparent and translucent types. Used for covers and safety guards, utilizing polished wire glass, or tempered glass.

- 2 - 4 - - - -
BOOTH FELT—Booth Felt Company, Brooklyn, N. Y. Wool-base felt; furnished in sheets or strips for machining or stamping into parts; also precision-cut mechanical felt parts: heat resistant to 400 F; ts, 5-100 psi; available in colors in all standard SAE types and grades. Used for washers, gaskets, grease seals, and pads for insulating machinery or reducing vibration.

1 - - 4 5 - - -
BRANDYWINE FIBRE—Brandywine Fibre Products Co., Wilmington, Del. Paper-base; furnished in sheets, tubes and rods; for machining and forming into parts. Abrasion resistance, medium; resists corrosion caused by weak acids; heat resistant to 300 F; flexibility, medium; dielectric str, 300 volts per mil; moisture absorption, medium; available in red, gray and black; shatterproof; sp gr. 1.35; translucent and opaque; machinability, good; takes high polish. For small mechanical and electrical parts.

1 - 3 - - - - -
BUTAPRENE—Firestone Tire & Rubber Co., Akron, O. Synthetic rubber for molding, extruding, calendering and spreading. Has high abrasion resistance when properly compounded: resists corrosion caused by most acids, alkalis and salts; heat resistant to 275 F; flexibility, high; ts, up to 3500 psi; moisture absorption, low; takes color; shatterproof at temperatures above —40 F; sp gr, 0.96-1.0; translucent. For all automotive and aeronautical rubber parts requiring resistance to oils and fuels and marine and filling station pumps.

C

1 2 - - - - - -
CARBOCELL—National Carbon Co. Inc., New York 17. Porous carbon available in a variety of standard and special elements, in open and blind-end tubes, rods up to 36 inches in length and 6⅝ in. in diam, and plates with maximum dimensions of 12 x 12 x 1½ in. and disks up to 12 in. in diam. Easily machined and fabricated into shapes; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock. For use in filtration of corrosive liquids and gases and in conditions where thermal shock may be expected in chemical and process industries.

- 2 - - - - - -
CARDOLITE Resins—Irvington Varnish & Insulator Co., Irvington N. J. Derived from cashew nut shell liquid, a high molecular weight unsaturated material with phenolic characteristics. Include brake-lining binders, friction fortifiers and types used in manufacture of electrical insulation; laminating, impregnating and sealing resins.

1 - - 4 - - 7 -
CARRARA Structural Glass—Pittsburgh Plate Glass Co., Pittsburgh 19. Plate glass generally chemical resistant; nonflammable; low flexibility; ts, 6500 psi; moisture absorption, low; available in black, white, ivory, gray, beige, jade, forest green, wine, orange and Rembrandt blue; sp gr at 70 F, 2.43. For work surfaces, separators, etc.

- - - 4 - 6 - -
CATABOND—Catalin Corp., New York. Phenolic base, thermosetting; furnished as liquid resin for laminating and bonding; nonflammable; moisture absorption, low; fungi-resistant. Used for abrasive wheels, laminated products, surface coating, impregnating and bonding.

1 2 - - - - - 8
CELITE—Johns-Manville, New York 16. Diatomaceous silica material; furnished in powdered, granular and brick forms; resistant to chemical corrosion; heat-resistant; nonflammable. Brick used for insulation of equipment operating at high temperatures; powder for filter aids, etc.

1 - - - - - 7 8
CELL-TITE—Sponge Rubber Products Co., Shelton, Conn.

Soft rubber, thermosetting; furnished in sheets, rods or tubes. Abrasion resistance, low; resists corrosion caused by acids and alkalies; flexibility, high; ts, to 150 psi; moisture absorption, very low; available in color; shatterproof; sp gr, 0.165-0.5; opaque; machinability, fair. For insulation.

1 - - - - - 7 8
Hard; thermosetting and thermoplastic; in sheets, rods or tubes and in laminated and molded (board) form. Abrasion resistance, low; resists corrosion caused by acids, alkalies; heat resistant to 285 F; flexibility, medium; ts, 100-300 psi; comp str, 100-450 psi; flexural str, 500-1500 psi; moisture absorption, low; shatterproof; sp gr, 0.08-0.50; opaque. For insulation.

1 - - - - - - -
CELLULAK—Continental-Diamond Fibre Co., Newark, Del. Shellac thermosetting material; furnished in tubes, for compression rolling. Abrasion resistance, medium; resistant to oils and greases. Max. cont. serv. temp, 180 F; dielectric strength, 750 volts per mil; machinability, fair; opaque. For electrical insulation and oil resistant spacers.

1 - - - 5 - - -
CENTRALINE—Central Paper Co. Inc., Muskegon 28, Mich. Wood-cellulose fiber, bleached or unbleached, or of specialty fiber; furnished either coated or saturated with plastic materials; in rolls or sheets, both plain and laminated of two or more thicknesses; abrasion-resistant; resists corrosion caused by atmospheric conditions; heat-resistant; flexible or stiff; low dielectric strength or as high as 500 volts per mil depending on final thickness of paper; ts, 7500-8500 psi; moisture absorption, varied; available in color; translucent or opaque. Used for coils, motors, gaskets, shims, noncorrosive separations, insulating, filtering, etc.

1 - - - - - 7 8
CERAWARE—General Ceramics Co., New York. Ceramic material for molding, casting, machining and extruding; abrasion resistance, high; resists corrosion except by hydrofluoric acid and caustic alkalies; flexibility, low; heat-resistant to 250 F; ts, 2000 psi; comp str, 80,000 psi; moisture absorption, low; sp gr, 2.2; opaque; machinability, fair. Used for chemical equipment generally.

1 - 3 - - - 7 -
CHEMIGUM—Goodyear Tire & Rubber Co., Akron 16, O. Butadiene acrylonitril synthetic rubber; thermoplastic; for molding and extruding into parts. Abrasion resistance high; resists corrosion caused by acids, alkalies and oils. Good low temperature flexibility; ts, 3500 psi; moisture absorption, low; non staining. For gaskets, seals, vibration dampeners, hose tubing, general rubber compounding.

- 2 - - 5 - 7 -
COHRLASTIC—The Connecticut Hard Rubber Co., New Haven, Conn. Silicone elastomer on fiberglas; furnished in sheet and strip. Abrasion resistance, medium; chemical resistance, good except for aromatics and concentrated acids and alkalies; max cont. serv temp, —70 to 300-500 F; flammable at 1000-1500 F; flexibility, high; dielectric str, 550-1100 volts per mil; moisture absorption, low; available in white, opaque; shatterproof. For resilient gaskets and tapes when heat resistance and/or high dielectric strength over the entire temperature range are required.

1 2 - - - - 7 -
COLONIAL CERAMICS—The Colonial Insulator Co., Akron, O. Ceramic base material for molding, casting, stamping and extruding. Has high abrasion resistance; resists corrosion caused by most acids and alkalies; max cont. serv. temp, 750 F; moisture absorption, low; available in colors, opaque; machinability, poor. For electrical control parts, thread guides, etc.

1 2 - - - - - 8
CONSERVO—Hewitt Rubber of Buffalo, Div. Hewitt-Robins Inc., Buffalo 5. Rubber for hose, belting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

- 2 - - - - 7 8
CORDIERITE—General Ceramics & Steatite Corp., Keasbey, N. J. Ceramic in sheet, rods or tubes, and plates. Abrasion resistance, low; resists acids and weak alkalies, except hydrofluoric acid. Max cont. serv. temp, 2200 F; nonflammable; transverse str, 8500 psi; moisture absorption, low; sp gr, 2.38; available in light tan, opaque. For use where high heat shock resistant ceramic material is required.

D

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DENSEWOOD—Densewood Corp., Elkhorn, Wis. A wood-base, thermoplastic material to be machined into parts. Abrasion resistance, medium; heat resistant to 350 F; flexibility, low; ts, 18,000 psi; comp str, 14,400 psi; moisture absorption, low; nonflammable; sp gr, 1.15; opaque; can be highly polished. Used for pulleys, rollers, pushbuttons, etc.

- - 3 4 - - - -
DENS-TRECH — Technical Ply-Woods, Chicago 1. High-pressure plywood; thermoplastic; furnished in sheet form for machining into parts. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

- - 3 4 - - 7 -
DIE-TECH—Technical Ply-Woods, Chicago 1. Wood and phenolic base plywood; thermosetting; furnished in sheet form for machining into parts. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

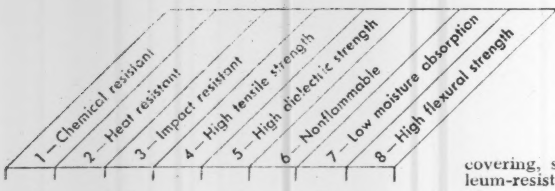
- 2 - - 5 - 7 -
DOW CORNING DC 996—Dow Corning Corp., Midland, Mich. Electrical insulating varnish; for dipping and vacuum impregnating. Abrasion resistance, medium; good resistance to dilute acids, concentrated hydrochloric dilute, and concentrated alkalies, mineral oil and salt solutions. Max cont. serv. temp, 400 F; flexibility, high; dielectric str, 2500-3000 volts per mil; moisture absorption, low; available in brown; shatterproof; sp gr 1.01-1.02; opaque. For impregnating motors, transformer coils and solenoid coils with inorganic materials.

- 2 - - - - 7 -
DOW CORNING DC 2103—Dow Corning Corp., Midland, Mich. Silicone resin for bonding rigid inorganic laminates; furnished in fluid state or in sheets, rods or tubes, or plates for molding or machining. Abrasion resistance, medium; chemical resistance, excellent; max cont. serv. temp, 400 F; nonflammable; dielectric str, 270 volts per mil; ts, 14-17,000 psi; comp str, 34-36 000 psi; transverse str 9-11 000 psi (tensile crosswise); flexural str 18-22 000 psi; moisture absorption, low; produced in straw color; opaque. Has high resistance to tracking. For electric panel board transformer tubes and electrical parts.

1 - 3 - 5 - - -
DUFELT—Felters Co., Boston. Laminated felt and Neoprene. Various thicknesses and lamination arrangements. Corrosion-resistant. Used for washers and strips for oil and grease retention where conditions are too exacting for use of plain felt. Petroleum-resistant.

See advertisement, Page 259

1 - 3 - - - - -
DUOLITE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated window glass with Vinal plastic binder; furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 180 F; flexibility, low; moisture absorption, low; nonflammable; shatterproof; transparent; highly polished. For windows which need not be optically perfect.



1 - 3 - - - 7 -
DUPLATE—Pittsburgh Plate Glass Co., Pittsburgh. Laminated plate glass and Vinyl plastic binder, furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat-resistant to 180 F; flexibility, low; moisture absorption, low; nonflammable; shatter-resistant; transparent; highly polished. For shatter-resistant windows, including those of high optical quality.

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EAGLE BRAND—Felters Co., Boston 11. Felt furnished in sheets, strip and rolls, for oil and dust seals, washers, gaskets, vibration dampening pads, etc.

See advertisement, Page 259

- 2 - 4 - - - 8
EEL-SLIP—Johns-Manville, New York 16. Asbestos fiber, graphite and rubber compound; heat-resistant; high tensile strength; nonflammable. Used for bearings, suction box covers, etc.

F

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FABROIL—General Electric Co., Pittsfield, Mass. Fiber material, furnished in gear blanks for machining. Has high impact resistance. Used for gears.

See advertisemnt, Page 303

1 - 3 - 5 - - -
FARLITE COMPREG—Farley & Loetscher Mfg. Co., Dubuque, Ia., wood veneer impregnated with thermosetting synthetic resins before compressing; available in several grades. Thicknesses to 2 in.; for machining with same tools as for cast iron. Material has good impact and corrosion-resistance; has low moisture absorption; ts, 30,000 psi; comp str, 23,000 psi; good dimensional stability; modulus of rupture in bending, 35,000 psi. Used for bearing plates, bolts, studs, propeller blades, instrument panels, mechanical spacers, etc.

1 2 - - - - - 8
FEATHERWEIGHT—Keasbey & Mattison Co., Ambler, Pa. Magnesia blocks, pipe covering and cement. Combination of magnesia and asbestos in powder or molded form with exceptionally low thermal conductivity. Used as a thermal insulating material where temperature does not exceed 600 F.

1 2 - - - - - -
FELPRO—Felt Products Mfg. Co., Chicago 7. Fiber, rubber, cork and felt material furnished in sheets and strips and in fabricated parts. Can be stamped or extruded into parts. Used for gaskets.

See advertisement, Page 280

1 - - - - - - -
FELTAN—American Felt Co., Glenville, Conn. Rubberized felt, microporous sheet material, also available in strip or cut parts; for stamping. Abrasion resistance, medium; chemical resistance, as required; max cont. serv. temp, 300 F; nonflammable; flexibility, high; ts, 100 psi; transverse str, 10 psi; flexural str, high; elongation, 1500 per cent; moisture absorption, high; available in red, brown, black, grey, tan and white; opaque; shatterproof; sp gr, 1.2. Nonskid surfacing material for instruments, machines and vibration mountings, filters, etc.

1 - - - 5 - - -
FELTERS FELT—Felters Co., Boston. Nonwoven felts to SAE and other specifications. Available either in the piece or cut to customer's requirements. Used for pads, bumpers, antisqueak and rattle parts, filters, polishing roll covering, shaft and bearing seals, etc. Petroleum-resistant.

See advertisement, Page 259

- 2 - 4 - - 7 8
FIBERGLAS — Owens-Corning Fiberglas Corp., Toledo, O.

Wool and textile; Three kinds of wool-type fibers: (1) for thermal and accoustical insulation, compressed to various densities, in form of bats, blankets, blocks, etc.; (2) for thin porous bonded mats; (3) for filter or aeration packs (coarse fibers). Two types of textile fibers—continuous filament and staple fiber—for service fabrics, chemical filtration, electrical insulation, reinforcement in laminates, plastics, etc. Basic properties; light weight, low thermal conductivity. Wool products have good sound absorption, are resistant to moisture, individual fibers are incombustible, durable, sanitary, wide temperature range (from subzero to 1000 F).

1 - - - - - 7 8
Thermal insulations include medium and high-temperature blocks, low-temperature (asphalt-enclosed) blocks, pipe insulations, metal mesh blankets etc., for all industrial equipment applications.

1 2 - - - - - 8
Electrical insulations for magnet wire, motors, generators, transformers — varnished cloths used for high temperature cambric applications; inorganic backing and reinforcement in mica combinations; for producing electrical laminates; for high temperature electrical adhesive tape. Tapes used for binding coils and other parts to be impregnated after wrapping; various electrical applications. Electrical tying cord for binding coils in generators and armatures, in transformers and similar static applications. Braided sleevings are used for lead wires in motors and transformers and similar applications.

1 2 - - - - - 8
Industrial textiles for high temperature pipe lagging, welding curtains, and chemical filter cloths.

Dust-stop air-filters; used wherever air is moved mechanically in ventilating, heating and air-conditioning systems and in forced warm air furnaces.

See advertisement, Page 164

1 - - - - - - -
FIDELITY Felt—Fidelity Felt & Mfg. Co., Philadelphia 40. Felt furnished in sheets for stamping. Used for washers, gaskets and strips for oil retention, reducing vibration, dust seals, etc.

- 2 - - - - - 8
FIRECRETE—Johns-Manville, New York 16. A castable refractory for furnace covers and bottoms, door linings, special shapes and many other types of monolithic refractory construction. Furnished in three grades; Standard Firecrete for temperatures up to 2400 F; High Temperature Firecrete up to 2800 F; and Light Weight Firecrete up to 2200 F.

1 - 3 - - - - -
FLEXSEAL—Pittsburgh Plate Glass Co., Pittsburgh. Laminated plate glass with extended Vinyl plastic edge, furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat-resistant to 180 F; flexibility, medium; moisture absorption, low; shatterproof; transparent; highly polished; flexible edge simplifies installation. For windows having nonrigid frames or windows requiring an airtight edge seal.

- - - 4 5 - - -
FYBEROID—Wilmington Fibre Specialty Co., Wilmington 99 Del. Paper base; furnished in sheet form, for machining or stamping into parts; dielectric strength, 200-400 volts per mil; ts 5000-8000 psi; flexible; abrasion and corrosion-resistant. Used for insulation on motors, generators, automotive ignition starters, etc.

- - 3 4 5 - - -
FYBR-TECH—Technical Ply-woods, Chicago 1. Fiber and wood base plywood; thermoplastic; furnished in sheet form for molding. Abrasion resistance, medium; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; high dielectric strength; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; available in gray, red, green or white fiber faces; shatterproof; machinability, good.

G

1 2 - - 5 - - -
GR-1 (Butyl Rubber)—Stanco Distributors Inc., New York 4. Synthetic rubber, isobutylene-diolefin polymer; vulcanizable by the same process as used for natural rubber; furnished in sheets for molding or extruding into parts. Abrasion resistance, medium; resists corrosion caused by acids and alkalies; heat resistant to 300 F; flexibility, high; dielectric constant, 2.1 at 1000 cycles; ts, 3400 psi; moisture absorption low; sp gr, 0.91; translucent. Used for machine mountings, chemical equipment, electrical insulation, etc. Air seepage, low.

- - - 4 - - - -
GASKOFELT—Western Felt Works, Chicago. Compact combination of felt with an oil-resistant rubber compound of great density and high tensile strength. Used for gasketing in connection with oil, steam, hot or cold water; temperatures up to 250 F; pressures up to 225 lb.

See advertisement, Page 144

1 2 - - - - 7 -
GENERAL Aluminum Oxide—General Ceramics & Steatite Corp., Keasbey, N. J. Ceramic furnished in rods or tubes and plates. Abrasion resistance, high; nonflammable; transverse str, 29,000 psi; moisture absorption, low; available in white, opaque. For use where high strength for insulation is required.

- - 3 - - - - -
GENERAL Rubber—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind. All types of rubber, molded and extruded. For gaskets, grommets, bushings, rings, pump diaphragms, washers, casters, extruded seals, channel strips, glass-run channels, etc.

1 2 - - - - - -
GRAPHICELL—National Carbon Co. Inc., New York 17. Porous graphite, available in plates, tubes and rods; uniform high porosity and small pore size; easily machined and fabricated into shapes; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock; resistant to oxidation; high electrical conductivity. For filtration and gas dispersion.

1 2 - - - - - -
GRAPHITAR—United States Graphite Co., Saginaw, Mich. Carbon-graphite material used for bearings, thrust washers, seals, rotor vanes, etc., made in several grades of which the following is typical. Comp str, 22,000 psi; apparent density (gr per cu cm), 1.77; transverse breaking strength, 10,500 psi; scleroscope hardness, 85; coef of thermal expansion 75-620 F (in. per in. per deg F), 0.0000015.

See advertisements, Pages 147, 160-161

H, I

1 - - - 5 - - -
HARVEL Insulating Varnishes—Irvington Varnish & Insulator Co., Irvington, N. J. Special phenol-formaldehyde, polymerization type varnishes with exceptional penetrating power, excellent electrical properties; noncorrosive; unusual resistance to acids, dilute alkalies, moisture, lubricating and transformer oil; save baking time required; harden by polymerization rather than oxidation and cure to infusible nonthermoplastic state. For use with any type of insulation. Also oleo-resinous types in clear and black, air-drying, baking.

- - - - - - 7 -
HASKELITE — Haskelite Mfg. Corp., Grand Rapids 2, Mich. Resin-bonded plywood; light weight; high strength; elastic; hard; bendable into desired forms and shapes. Used for airplanes, buses, street cars, railways, radio cabinets and speakers, passenger cars, etc.

See advertisement, Page 276

- 2 3 4 - - - -
HERCULITE—Pittsburgh Plate Glass Co., Pittsburgh. Tempered or heat-treated plate glass, furnished in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 650 F; flexibility, medium; ts, 29,500 psi; moisture absorption, low; nonflammable; sp gr, 2.52; transparent; highly polished. For use as windows or any glass application requiring unusual strength.

1 2 - 4 5 - 7 -
HYCAR—B. F. Goodrich Chemical Co., Cleveland. Vulcanizable types of synthetic rubbers of butadiene base furnished in crude sheet

1—Chemical resistant
2—Heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Low moisture absorption
8—High flexural strength

form to be compounded into any type of stock desired for further processing by molding, extruding, calendering, etc.

1 2 - 4 - - - -
Type OR-15 (oil-resistant); vulcanizable synthetic rubber, butadiene-acrylonitrile copolymer; furnished in sheet form; for molding, extruding and calendering; excellent oil, heat, abrasion and aging resistance; excellent flex life; ts, 2500-4500 psi; dielectric strength, 500 volts per mil; moisture absorption, medium; may be compounded in colors, or for blending with vinyl and phenolic resins. Used for all resilient parts.

1 2 - 4 - - - -
Type OR-25 (oil-resistant); vulcanizable synthetic rubber, butadiene-acrylonitrile copolymer; furnished in sheet form; for molding, extruding and calendering; abrasion resistance, high; resists corrosion caused by petroleum products; heat-resistant to 300 F; flexibility, high; dielectric strength, 500 volts per mil ts, 2000-3500 psi; moisture absorption, low. May be compounded in colors.

- 2 - - 5 - - -
Type OS-10 (oil-soluble); vulcanizable synthetic rubber, butadiene-styrene copolymer; furnished in sheets; for molding, extruding and calendering; flexibility, high; ts, 2000-3000 psi; moisture absorption, low; takes color. For abrasive wheels, electrical insulation, and general replacement for natural rubber.

All types used for gaskets, tubing, vibration insulators, packings, hose, printing rollers and blankets, wire covering and jacketing, and any other general type of application where resilient materials are required. All can be compounded to bonehard (Ebonars) with a 100 F higher softening point than obtainable with natural hard rubber. All types also available in latex state for spreading, dipping and coating.

See advertisement, Page 142

- 2 - - - - - 8
HY-TEMP—Keasbey & Mattison Co., Ambler, Pa. Diatomaceous earth and asbestos base; combination heat-insulating blocks, cements and pipe covering; furnished in powder or molded form; high heat resistance; low moisture absorption; nonflammable; and low thermal conductivity. Used for thermal insulation up to 1900 F.

1 2 - - - - 7 -
INSULKOTE — Johns-Manville, New York 16. Weatherproof, heat-resistant coating for use over insulation of ducts and other exposed equipment.

- - - - - - 7 8
INTERNATIONAL Graphite — International Graphite & Electrode Corp., St. Marys, Pa. Graphite electrodes for electric furnaces, graphite anodes for electrolytic cells, graphite molds for casting alloys, pressure sintering and centrifugal casting.

- 2 - - - - - -
INTERLAKE 4257 Liquid Glue — Interlake Chemical Corp., Cleveland. Phenolic resin glue formed from pheon and formaldehyde in equal proportions under mild alkaline treatment; for bonding mineral wool. Bonded wool has good resiliency, excellent insulating properties.

1 - - - 5 - - -
IRVINGTON Varnish—Irvington Varnish & Insulator Co., Irvington, N. J. Insulating varnishes: synthetic, internal-drying, [illegible] insulating, oleo-resinous type varnishes; clear or black, baking air drying; black air-drying flashing or baking core-plate; clear or black oilproof finishing varnishes. Wide selection to meet ordinary and special requirements.

J, K, L

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JAMESTOWN Plywood—Jamestown Veneer & Plywood Corp., Jamestown, N. Y. Hot-pressed resin-bonded plywood; thermosetting; furnished in sheets for machining. Abrasion resistance, low; resists corrosion caused by moisture; heat resistant to 400 F; flexibility, low and medium; approx ts, 2000 psi; comp str, 250 psi; produced in natural wood; largely shatterproof; sp gr, .45-.60; machinability, good.

1 - 3 - - - - 8
"K" FELT—American Felt Co., Glenville, Conn. Kapok felts to Air Corps Specification 16098, Types I and II. Material is corrosion-resistant, impact-resistant and nonflammable; for insulating, etc.

1 2 - - - - - -
KGI—Kopp Glass Inc., Swissvale, Pa. Glass for marine, aviation, railroad and industrial applications. Types include technical glass, ultra-violet glass, heat-resisting glass, colored glass, crystal clear and opal glass.

1 2 - - - - - -
KARBATE—National Carbon Co. Inc., New York 17. Carbon and graphite base, corrosion-resistant materials and impervious to seepage of liquids and gases under pressure.

No. 10 Series (11, 12, 18, etc.); carbon base materials.

No. 20 Series (21, 22, 28, etc.); graphite base materials.

Available in the form of brick, plates, tile, pipe, fittings, and valve, pump and heat exchanger parts, tower sections and tower accessories such as bubble caps, trays, distributor plates, etc.; highly resistant to reaction with most materials encountered in chemical manufacturing plants and chemical processes at the concentrations and temperatures ordinarily employed; resist action of all acids, alkalies and salt solutions except those of a highly oxidizing nature. No. 10 series has a lower thermal conductivity than the No. 20, while the latter is more resistant to oxidation.

1 - 3 - - - - -
KOROSEAL—B. F. Goodrich Co., Akron, O. Flexible synthetic; furnished in various consistencies from jelly to bone-like hardness; corrosion and shock resistant; nonflammable; available in colors. Jelly is used for making molds for casting plastics; other compounds sold only as finished products. Superior to rubber in flexing, oxidation and penetration of moisture or gases; does not swell in oil. Available in molded and extruded forms and sheets; also applied as coating to paper and fabric.

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LAVITE—D. M. Steward Mfg. Co., Chattanooga, Tenn. Ceramic for molding, machining and extruding. Abrasion resistance, high; nonflammable; flexibility, low; dielectric str, 235 volts per mil; ts, 7200 psi; comp str, 96,000 psi; flexural str, 10 500 psi; moisture absorption, low; available in white, opaque. Can be used as a substitute for metal, fibre or plastic parts for mechanical use, such as washers bushings, etc. Material can be machined.

1 - 3 - - - - 8
LIGNUM-VITAE—Lignum-Vitae Products Corp., Jersey City, N. J. Natural tropical wood, 30 per cent volume is natural self-lubricating resin. Furnished in boards or logs for machining. Abrasion resistance, medium; resists corrosion caused by chemicals and light solutions; heat-resistant to 150 F; flexibility, low; moisture absorption, low; produced in natural color; opaque; hardness, 3-4 Moh's scale; soluble in alcohol and acetone. For bearings bushings, rollers, guides etc., where lubrication is difficult or impossible.

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LOF—Libbey-Owens-Ford Glass Co., Toledo, O.

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Heat-absorbing plate glass; furnished in sheet form; abrasion resistance, high; corrosion-resistant; heat absorbing; flexibility, medium; dielectric str, 0.204 kilovolts per mil; modulus of rupture 6500 psi; moisture absorption, low; nonflammable; sp gr, 2.52; transparent; highly polished. For use where light transmission or vision is desired with insulation against solar radiation.

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Polished plate glass; furnished in flat, bent and laminated form; in clear and colors; sp gr, 2.52; highly polished; high dielectric strength. Used for viewing windows.

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LORD—Lord Mfg. Co., Erie, Pa. Rubber-bonded-to-metal, for a variety of uses including shear-type mountings for vibration isolation. Typical applications include aircraft, automotive, and marine engines; motors, pumps, compressors, general machinery, radio equipment, instruments, etc., where vibration is encountered.

See advertisement, Page 149

1 - - - 5 - - 8
LUZERNE Hard Rubber—The Luzerne Rubber Co., Trenton, N. J. Hard rubber, thermoplastic; furnished in sheets, rods or tubes, for machining into parts; high polish; corrosion-resistant to acids and alkalies; dielectric strength 6 x 10^7 megohms constant at 28.8 C; ts, 3500-9000 psi; heat resistant to 120 F; available in some colors; sp gr, 1.24; comp str, 8000-12,000 psi. Used for electrical, chemical, medical and other parts requiring high dielectric strength.

M, N

- 2 - - 5 - 7 -
MICABOND — Continental-Diamond Fibre Co., Newark, Del. A built-up mica material; furnished in sheets and tubing, for machining and forming into parts. Bonded together with shellac or synthetic resins to provide high dielectric and heat-and-moisture resistant properties. Available in two types: standard, for general use, and super for special applications requiring unusually high heat resistance and dielectric strength. Each type is produced in a number of grades for specific applications. Used for V-rings, washers, segments and various special shapes.

1 2 - - - - - 8
MONARCH—Hewitt Rubber of Buffalo, Div. Hewitt-Robins Inc., Buffalo 5. Rubber for hose, belting and packing. Can be furnished extruded or for molding. Abrasion resistance, high. For use wherever hose, belting or packing are required.

1 2 - - - - - -
MORGANITE—Morganite Brush Co. Inc., Long Island City, N. Y. Carbon-graphite, and carbon-graphite-metal mixtures; in finished rods or bars and plates, for turning, boring, molding, etc. Resists corrosion caused by any liquid handled industrially; resists heat to 700 F; good abrasion resistance; ts, ult 1000-3000 psi; comp str, 10-30 000 psi; ductility, low; sp gr, 2-2.15. Used for bearings, valves, seals, nonfriction slides, piston rings, etc.

See advertisement, Page 158

- - 3 - - - - -
MULTIPLATE — Pittsburgh Plate Glass Co., Pittsburgh. Multiple laminated plate glass, Vinyl plastic binder; furnished in cut sizes and shaped. Corrosion and abrasion resistance, high; shatterproof; transparent; highly polished. For protection against high velocity missiles.

- 2 - - 5 - - -
MYCALEX — General Electric Co., Pittsfield, Mass. Ceramic base thermoplastic; furnished in sheet, rods or tubes, or molded to specifications; for molding or machining into parts; abrasion resistance, moderate; can be highly polished; corrosion-resistant; dielectric str, 350 volts per mil; ts, 5000-7000 psi; heat resistant to 600 F; low moisture absorption; nonflammable; available in gray only; opaque; comp str, 22-30 000 psi. Used for electrical insulation, switches, etc.

See advertisement, Page 303

1 2 - - - - - -
NATIONAL CARBON — National Carbon Co., New York 17. Carbon or graphite in amorphous or graphite form; made in a variety of shapes; molded, extruded or machined into parts. In graphitic form carbon possesses excellent lubricating properties; highly resistant to most acids alkalies and solvents. Used for sleeve bearings, packings, threaded parts, nozzles for corrosive liquids pipe fittings, valve parts, tubes, tower sections, etc. for the chemical and process industries.

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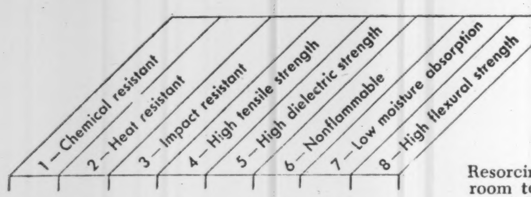
NATIONAL FIBRE—National Vulcanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, tough horn-like material; furnished in hard or flexible form in sheets, rolls, tubes, rods and fabricated



shapes; high dielectric and mechanical strengths: resistant to abrasion and shock; easily formed and machined; light in weight. Used for gears, valve disks, gaskets, washers, bobbin heads and electrical insulation etc.

See advertisement, Page 269

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NATIONAL Switch Insulation—National Vulcanized Fibre Co., Wilmington, Del. Combination laminated Bakelite core with vulcanized fiber surfaces; available in sheets and fabricated shapes: high tracking (arc) resistance combined with rigidity and minimum warpage; high dielectric and mechanical strengths; low moisture absorption; easily stamped and fabricated. Used in switches to support and insulate current-carrying parts.

See advertisement, Page 269

1 2 - - - 6 - -

NEOPRENE—E. I. du Pont de Nemours & Co. Inc., Arlington, N. J. Chloroprene rubber; available as hose, wire, cable, sheets, tank linings, gaskets, packing, tubing, belting, diaphragms, industrial truck tires and molded goods. Used as binder for cork and asbestos. Is employed to impregnate or coat canvas, duck or other fabrics. Strength, abrasion resistance, resilience and elasticity of rubber: resistance to deterioration from contact with oils, greases, gasoline, heat, chemicals, sunlight and ozone: corrosion-resistant; will not support combustion; low moisture absorption: ts 4000 psi; available in colors. Used for machine applications where rubber characteristics are required but where the product is to be subjected to deteriorating influences.

See advertisements, Pages 272, 317

O, P

1 2 - 4 - - - -

OHIO Carbon or Carbon Graphite—The Ohio Carbon Co., Cleveland 11. Carbon furnished in rods or plates. Abrasion resistance, medium; chemical resistance, high; max cont. serv. temp, 400-500 F; flexibility, low; ts, 2275 psi; comp str, 7-9000 psi; transverse str, 6500 psi or more; moisture absorption, low; available in black and natural; machinability, fair. For bearings such as slow speed bearings and thrust bearings, seals for pumps, etc.

- 2 - 4 - - 7 -

ORNAMETL—Haskelite Mfg. Corp., Grand Rapids 2, Mich. Wood veneer on steel, furnished in sheets, for stamping, rolling and pressing. Semiflammable; moisture absorption, low; available in mahogany, walnut, and birch veneers: shatterproof; machinability, good. Used for airplanes, buses, street cars, railways, etc.

See advertisement, Page 276

1 - 3 4 - - - -

PAMUDO Plywood—Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash. Douglas fir plywood, furnished in stock sheet sizes. Has high chemical resistance, high impact resistance and high tensile strength. (U. S. Commercial Standards CS-45-45). For various industrial applications and uses in conjunction with metal parts.

- - 3 4 - - 7 -

PEARL CITY Plywood—Pearl City Plywood Co. Inc., Jamestown, N. Y. Plywood and veneers for cold press gluing, furnished in sheet form. Nonflammable; flexibility, as required; moisture absorption, low; produced in all woods; machinability, good. For treads, etc.

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PEERLESS — National Vulcanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, fish paper insulation; furnished in sheets and rolls; high dielectric strength combined with toughness, springiness and good bending properties. Used extensively for generator and motor insulation and various other electrical insulation applications.

See advertisement, Page 269

- - - 4 - - 7 -

PENACOLITE G-1131—Penacolite Div., Pennsylvania Coal Products Co., Petrolia, Pa. Resorcin resin adhesive, capable of curing at room temperatures, providing durable, waterproof bonds. Recommended for bonding of all cellulosic materials, most of the thermoplastic and thermosetting materials, as well as natural and some synthetic rubbers. Can be used with pressures as low as 25 psi. Recommended for use where strength and proof against water, weathering and dampness are required.

1 - 3 - 5 - - -

PENN Fibres—Penn Fibre & Specialty Co., Philadelphia 34.

"B" Board; pulp board, furnished in sheets and strips, for stamping and forming. Abrasion resistance, low; max cont. serv. temp, 200 F; flexibility, high; opaque. For washers, gaskets, stampings for electrical parts, etc.

Vulcanized fibre; paper base material, furnished in sheet and rods or tubes, for machining or stamping into parts. Abrasion resistance, low; resists corrosion caused by oils and greases; flexibility, low, and high when treated with glycerine; ts, 6500-8500 psi; comp str, 20-35,000 psi; nonflammable; available in red, gray, white and black olive; shatterproof; sp gr, 1.36-1.4; corrosion-resistant. For insulation, special gaskets, washers, special parts, dust-guards, pulleys and gears, etc.

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PENNVERNON — Pittsburgh Plate Glass Co., Pittsburgh 19. Double strength window glass, generally chemical resistant; nonflammable; flexibility, low; ts, 6500 psi; moisture absorption, low; sp gr at 70 F, 2.52; transparent. For use where unusual strength is required.

- 2 - - - - 7 -

PERBUNAN — Stanco Distributors Inc., New York 4. Synthetic rubber, butadiene-acrylonite polymer; (vulcanizable by the same process as used for natural rubber); furnished in sheets; for molding or extruding. Abrasion resistance, medium; resists swelling by oil; heat resistant to 300 F; flexibility, high (—65 F); dielectric constant, 15 to 60 cycles; ts, 3500 psi, min; moisture absorption, low; sp gr, 0.96; translucent; machinability, good. For gaskets, packings, mountings, etc. Also available in nonstaining grades for wh[illegible] goods.

- - - - - - 7 -

PHEMALOID — Haskelite Mfg. Corp., Grand Rapids 2, Mich. Compound lumber; phenolic resin bonded: furnished in sheets: waterproof; resistant to fungus, bacterial decay, and diverse climatic conditions; bendable to desired forms. Used for truck, bus and train floors, boat hulls and decks, etc. Supplied in flat stock only, in sizes 48 x 96 in., 56 x 96 in., and 72 x 96 in. Available in 96-in. widths and as long as is expedient to ship to special requirements where scarfiing is allowed.

See advertisement, Page 276

1 - - - 5 - 7 -

PHENOLITE—National Vulcanized Fibre Co., Wilmington, Del. Laminated phenolic; furnished with base of paper, cloth or asbestos in sheets, rods, tubes and fabricated shapes; also laminated with rubber sheet: high dielectric and mechanical strengths; low moisture absorption: heat-resistant: nonfusible; resistant to acids, solvents and oils: high resistance to wear and impact; machinable. Used in electrical, mechanical and chemical applications for silent gears, bearings, bushings, washers, valve disks and terminal strips, etc.

See advertisement, Page 269

1 - - 4 - - 7 -

PITTSBURGH Plate Glass — Pittsburgh Plate Glass Co., Pittsburgh 19. Plate glass, generally chemical resistant; nonflammable; low flexibility; ts, 6500 psi: comp str, 36 000 psi; moisture absorption, low; available in water white, blue, flesh-tinted, blue-green; sp gr at 70 F, 2.52. For food processing equipment, etc.

- 2 - - - - 7 -

PLASTIPLY—Haskelite Mfg. Corp., Grand Rapids 2, Mich. Plastic covered plywood; extremely stable under wide temperature and moisture variations when edges are sealed; high abrasion resistance; high in impact and tensile strength. Furnished in flat sheets and molded forms.

See advertisement, Page 276

- - - - - - 7 -

PLUSWOOD—Pluswood Inc., Oshkosh, Wis. Resin-impregnated plywood, heated by high frequency waves and simultaneously compressed under heavy pressure. Furnished in any desired thickness, in large or small sheets, in natural dark deep brown color. Has wood grain with high gloss finish; high density; lightweight; and is resistant to exposure. It can be sawed, drilled, turned, threaded, milled and tapped; nonflammable; highly resistant to decay, acids, alcoholic mixtures and other organic liquids. Sp gr, 1.3-1.4: ts (parallel laminated in fiber direction), 32-40 000 psi; comp str, 20-28,000 psi; impact (Izod), 6-8 ft-lb per in. of notch. For use as exhaust and blower fan blades, and in boat-building, aircraft and automotive industries.

- 2 - - 5 - 7 -

PLYCRAFT—Frank C. Snedaker & Co. Inc., 9th and Tioga Sts., Philadelphia 40, Resin-bonded plastic plywood with high tensile strength. Weatherproof; resistant to age, bacteria, fungi, oil, chemicals and gasoline; nonflammable; lightweight. Use of varieties of wood and bonded construction make it possible to predetermine and control hardness. Will not warp or buckle when exposed to alternate heat and cold, or stress, and once made, shape cannot be altered. Corrosion-resistant. Adaptable to any shape. Sound-dampening and nonconducting, making it desirable for use in motor, pump and generator housing, and in avoiding the danger of static. Also used in the aircraft industry, marine field, radio and communications, transportation, office equipment, agricultural machinery, etc.

- - 3 4 - - 7 -

PLYMETL—Haskelite Mfg. Corp., Grand Rapids 2, Mich. Resin-bonded plywood, sheet metal bonded to one or both faces: has stiffness, rigidity; lightweight; metal on both faces insuring freedom from warpage. Types available for different purposes are galvannealed steel, stainless steel, aluminum, copper, chrome zinc, chrome steel, porcelain, etc. Used for applications in the automotive and railroad fields.

See advertisement, Page 276

- - - - - - 7 -

PLYMOLD—Haskelite Mfg. Corp., Grand Rapids 2, Mich. Resin-bonded plywood, molded in simple or compound curvatures.

See advertisement, Page 276

- - 3 4 - - - -

PLY-TECH—Technical Ply-Woods, Chicago 1. Wood and phenolic base (plywood); thermoplastic: furnished in sheet form for machining. Abrasion resistance, medium: resists corrosion caused by moisture and termites; flexibility, medium; tensile and compressive strength, depend on construction: while moisture absorption depends on treatment; shatterproof; machinability, good.

1 - - - - 6 - 8

POLAROID—The Polaroid Corp., Cambridge, Mass. Light-polarizing glass and film. Principal property is 99.5 per cent polarization of transmitted light, uniformly over large area. Used for camera filters, polarizing attachments for microscopes, polarimeters, and other scientific instruments. Also for polariscopes to determine strain, three-dimensional motion picture apparatus and glareless auto headlights, nonpolarizing colored filters, etc.

- - 3 4 - - - -

PREG-TECH—Technical Ply-Woods, Chicago 1. Impregnated wood: thermoplastic; furnished in sheet form for machining into parts. Abrasion resistance, low; resists corrosion caused by termites and moisture; heat resistant to 350 F; flexibility, medium; tensile and compressive strengths depend on construction; moisture absorption depends on treatment; shatterproof; machinability, good.

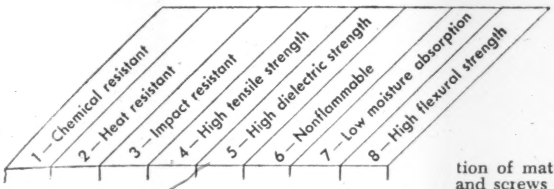
- - 3 4 - - - -

PREGWOOD—Formica Insulation Co., Cincinnati. Phenolic, impregnated, laminated, densified wood; thermosetting: for machining and pressing. Abrasion resistance, high; heat-resistant to 175 F: flexibility low: dielectric str, 200 volts per mil: ts, 30 000 psi; comp str, 20,000 psi: moisture absorption, low: inflammable: shatterproof: opaque; can be highly polished. For use as switch gear, instrument plates, fan and propeller blades, panels, etc.

See advertisement, Page 270

- - - 4 - - 7 -

PRESDWOOD—Masonite Corp., Chicago. Wood fiber board furnished in sheets ⅛, $\frac{3}{16}$, ¼,



inch thick, max size 4 x 12 ft, for machining into parts. Abrasion resistance, medium; chemical resistance, good to fairly weak solutions; max cont. serv. temp, 300 F; flexibility, low; ts, 3200 psi; comp str, 16,500 psi; transverse str, 5900 psi; moisture absorption, low; available in natural brown, opaque, shatterproof; sp gr, 1.02; machinability, good. For various industrial uses. This material is also available in "Tempered" and "S2S Tempered" grades.

1 2 - - - - 7 -
PURE Carbon—Pure Carbon Co. Inc., St. Marys, Pa. Furnished in plates for grinding; corrosion resistant; heat resistant; good machinability; good bearing properties. For seals and wearing rings, pistons, cylinder liners, thrust bearings, and for all types of brushes for electric motors and generators, etc.

See advertisement, Page 318

1 - - - - - 7 -
PYREX—Corning Glass Works, Corning, N. Y. Glass products such as tubing, cylinders, sheets, molded parts, etc., covering a wide range of chemical, physical and optical properties such as heat resistance, low or high thermal conductivity, low or high coefficient of expansion, excellent corrosion resistance; no appreciable moisture absorption; nonflammability; ability to bond to metal. Over 250 glasses regularly melted. Specific properties of typical product, PYREX brand piping, as follows: Linear coefficient of expansion .0000018 in. per deg F between 66-660 F. Thermal conductivity, 8.1 Btu/sq ft/hr/in./deg F at 77 F. Ts, 6000-10,000 psi; dielectric strength, very high.

- 2 - - 5 - - 8
PYROPLAX — Cutler-Hammer Inc., Milwaukee. Asbestos base; furnished in cold-molded pieces; heat resistant to 800-1000 F; nonflammable; dielectric str, 40 volts per mil; resistant to corrosion and abrasion. Used for machine parts where resistance to high temperature is needed.

R, S

1 - - 4 - - 7 -
REANITE—The United States Stoneware Co., Akron, O. Resinous base, thermosetting material, furnished in liquid form, for bonding metals to metals or rubber and plastics to metals; abrasion resistance, medium; resists corrosion caused by acids and alkalies; heat-resistant to 300 deg F; flexibility, high; ts, 3000 psi; moisture absorption, low; shatterproof; available in black only; opaque.

1 - - - - - - -
RESISTOFELT—Western Felt Works, Chicago. A lamination of high-grade wool felt and Neoprene. Used on revolving shafts; the felt lubricates the shaft and prevents entrance of dust; the Neoprene prevents passage of oil.

See advertisement, Page 144

1 - 3 4 - - - -
RESISTOFLEX — Resistoflex Corp., Belleville, N. J. Synthetic resin base, furnished in sheet and laminated form, and in rods or tubes; abrasion resistance, high; resists corrosion caused by oils, gasoline, and organic solvents; heat resistant to 250 F; flexibility, high; dielectric str, 10.7 volts per mil; ts, 5236 psi; moisture absorption, medium; available in color; transparent, translucent; shatterproof; sp gr, 1.259. For diaphragms, gaskets oil hydraulic and lubricating hose assemblies.

- - 3 4 - - - -
RESNPREST—Plylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore. Phenol-formaldehyde bonded plywood; thermosetting; strong by unit weight; panel ¼-in. thick and 12-in. sq. weighs approximately 12 oz and supports over 400 lb; panels to 9 in. thick can be furnished if desired, widths to 72 in. (sanded) or 96 in. (unsanded); lengths to 144 in.; special scarfed panels to 36 ft. Thicknesses up to 9 in. made on high frequency thermal press for gusset plates, etc. Cross-ply construction of material makes it splitproof and nails and screws can be fastened to very edge with safety. Resists heat and cold; and has low moisture absorption. Used wherever rigidity and lightweight is needed. Guaranteed against ply separation.

- - - 4 5 - 7 -
RUBEROID Insulating Tape—The Ruberoid Co., New York 18. Electrical insulating tape. Abrasion and chemical resistance, high; max cont. serv. temp, 212 F; flexibility, high; high dielectric, tensile, transverse and flexural strengths; available in black, opaque; shatterproof.

1 - - - 5 - 7 -
RUB-EROK—The Richardson Co., Melrose Park, Ill. Special rubber furnished in sheet form; corrosion-resistant; high dielectric strength; low moisture absorption; low loss factor. Used for electrical insulation.

See advertisement, Page 162

1 - - - 5 - 7 -
RUB-TEX—The Richardson Co., Melrose Park, Ill. Hard rubber molded into parts, particularly desirable for electrical, heat and cold insulation; for industrial uses.

See advertisement, Page 162

1 2 - - - - - -
SILASTIC—Dow Corning Corp., Midland, Mich. Silicone rubbers furnished in crepe and paste for molding, coating, machining, extruding, laminating and friction calendering. Medium abrasion resistance; good resistance to oil, aqueous, neutral amonical reagents and concentrated sodium hydroxide. Some stocks resistant to strong acids except concentrated sulfuric. Max cont. serv. temp, 300-350 F; nonflammable; flexibility, high; dielectric strength, 500-1100 volts per mil depending on grade; ts, 400-700 psi; low moisture absorption; available in red and white; sp gr, 1.3-2.3 depending on grade; opaque. Has high oxidation resistance. For gaskets, diaphragms, seals, packings, tubing, mountings, wire insulation, and weather resistant rubber parts.

- - 3 - - - - -
SILENTBLOC—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind. Metal combined with natural or synthetic rubber for mountings, bearings and couplings. Used also for motor and machine mounts to control vibration and cushion shock loads; lubricationless oscillating or torque joint; and bushing to correct misalignment in bearings, hinges and shaft supports. Applications include industrial and household equipment, automotive, aircraft and marine fields; motors; electrical equipment; railroad equipment; farm machinery; etc.

- 2 - - - - - -
SIRVENE—Chicago Rawhide Mfg. Co., Chicago. Synthetic rubber compounds molded into parts; resistant to oils and heat, oxidation and weather. Used for sealing oils and greases, packings, gaskets, covers and special parts.

- 2 - - - - - -
SIRVIS—Chicago Rawhide Mfg. Co., Chicago. Special tanned abrasive and heat-resisting leather Used for all types of packings, gaskets and mechanical leather parts.

1 - - - 5 - - -
SPAULDING ARMITE — Spaulding Fibre Co. Inc., Tonawanda, N. Y. Hard vulcanized fibre material (fish paper); sheets and rolls for stamping or forming into parts; flexible; dielectric str, 200-550 volts per mil; abrasion and corrosion-resistant; ts, 9000-15,000 psi.

- - - 4 5 - - -
SPAULDING FIBRE—Spaulding Fibre Co., Inc., Tonawanda, N. Y. Hard vulcanized [illegible] materials; sheets, rods and tubes, for machining, stamping or forming into parts; dielectric str, 150-400 volts per mil; ts, 9000-15,000 psi; available in colors; resistant to shock. Used for mechanical and electrical applications where toughness, lightweight and machining and forming properties are essential.

- 2 - - 5 - - -
SPAULDO—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Fibre material [illegible] in sheets and rolls, for machining or stamping into parts; flexible; dielectric str, 300 volts per mil; heat resistant to 220 F; high polish; corrosion-resistant; ts, 5000-16,000 psi; resistant to shock. Used for applications where flexibility and toughness in both grain directions are essential.

- - - - - - - 8
SPEER—Speer Carbon Co., St. Marys, Pa. Carbon, electrographite, metal-graphite materials; in finished plates, bars, rods, for further machining. Not attacked except by oxidizing chemicals; starts to oxidize at 500 C; sp gr, 2-2.20; ts, 1000-4000 psi; crushing, 2800-4500 psi. Used for contacts, bearings, molds, dies, seal rings, etc.

1 - 3 - - - - -
SPONGEX—The Sponge Rubber Products Co., Shelton, Conn. Sponge rubber furnished in sheets, strips, rods and tubes, extruded or for molding. Abrasion resistance, low; chemical resistance, excellent against many commercial chemicals and oils; max cont. serv. temp, 175 F; flexibility, high; ts, 25-150 psi; available in black, tan, red and other colors; opaque; shatterproof. For vibration elimination, cushioning, sealing and gasketing.

1 - - - - - 7 8
STEATITE—General Ceramics & Steatite Corp., Keasbey, N. J. Ceramic material furnished in finished parts, rods, tubes and plates Abrasion resistance, high; resists corrosion caused by alkalies and acids; heat resistant to 1800 F; dielectric str, 300 volts per mil; ts, 9500 psi; comp str, 81,000 psi; moisture absorption, none; produced in white; impact resistance, 2.27 psi; sp gr, 2.7; opaque. For light bearings, radio frequency insulating parts, etc.

- 2 - - - 6 - 8
STONEWALL—The Ruberoid Co., New York 18. Asbestos cement board, furnished in sheets. Abrasion resistance, high; max cont. serv. temp, 450-500 F; nonflammable; flexibility, low; ts, 1900 psi; comp str, 10,000 psi; modulus of rupture, 3500 psi; moisture absorption, medium; available in natural gray, opaque; shatterproof; sp gr, 1 92. For electrical control bases, switch cells, etc.

- 2 3 4 5 - 7 -
STUPAKOFF—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

- 2 - 4 5 - - -
No. 621; Steatite ceramic furnished in finished form or for molding, casting, machining, stamping, extruding. Abrasion resistance, high; resists corrosion caused by acid and alkalies, except hydrofluoric acid; dielectric strength, 200 volts per mil, inst.; ts, 9000 psi; comp str, 75,000; moisture absorption, low; available with colored glaze; sp gr, 2.6; opaque. For electrical insulating parts.

- 2 3 - - - 7 -
No. 1100; ceramic furnished in rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 1800 F; nonflammable; flexibility, low; ts, 7000 psi; comp str 70,000 psi; flexural str, 18,000 psi; available in white to cream colors, opaque; shatterproof; sp gr, 2 56. For use in radio and high-frequency applications.

- - - - - - 7 -
SUPERIOR Carbon—Superior Carbon Products Inc., Cleveland 5. Fabricators of electrical and mechanical molded metal and carbon brushes, sealing rings, thrust bearings, bushings, relay contacts, silver contacts, etc.

See advertisement, Page 312

- - 3 4 - - - -
SWEET HOME BRAND—Am-mex Sales Co. Inc., Buffalo. Phenolic resin-bonded, thermosetting fir plywood, machined into parts; moisture and water-resistant. Used for aircraft cabinets, instrument panels, bases, bodies, boats, etc.

- - - - - - - 8
SYROCOWOOD—Syracuse Ornamental Co. Inc., Syracuse, N. Y. Molded wood; thermosteeing and thermoplastic; furnished as molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates or decorative parts, also for radio type control knobs.

T

1 - - - - - 7 -
TEGO—Resinous Products & Chemical Co., Philadelphia 5. Synthetic resin adhesive, phenolic resin film, dry sheet. Has low moisture absorption, high density. Used in manufacture of waterproof plywood for aircraft and marine use.

1 - - - - - 7 -
TENSILASTIC—American Wringer Co. Inc., Woonsocket, R. I. Hard and soft rubber and rubber synthetics for rolls and linings and

1—Chemical resistant
2—Heat resistant
3—Impact resistant
4—High tensile strength
5—High dielectric strength
6—Nonflammable
7—Low moisture absorption
8—High flexural strength

covering of tank parts, etc. Available in any size from ½-in. long and ½-in in diam to 300 in. long and 44 in. in diam; any density from dead hard to very soft; compounded to meet mechanical and chemical requirements; heat resistant to 180 F; flexibility, high; moisture absorption, low.

1 - - - - - - 8
THERMOPANE—Libby-Owens-Ford Glass Co., Toledo. O. Metal-to-glass edge-sealed with dehydrated dead-air space; furnished in flat units; abrasion resistance, high, resists corrosion; heat resistant to 150 F; flexibility, low; dielectric str, 0.204 kilovolts per mil; modulus of rupture, 6500 psi: nonflammable; moisture absorption, low; sp gr, 2.52; coefficient U for double-glass Thermopane with ¼-in. or ½-in. airspace approx .55; transparent and translucent. For insulated observation windows.

- 2 - - 5 - - 8
THERMOPLAX—Cutler-Hammer, Inc., Milwaukee. Bituminous base compounded with filler such as asbestos; cold-molded into parts; heat resistant to 400-600 F: nonflammable: dielectric str, 80-100 volts per mil; resistant to corrosion; takes high polish; ts 2000-4000 psi; moisture absorption, 2 per cent. Used for electrical and heat insulation.

1 - 3 - - - - -
THIOKOL—Thiokol Corp., Trenton, N. J. Synthetic rubber, available in four types: Crude, corresponding to crude rubber, water dispersions for coatings, liquid polymers, and molding powders; processed in manner similar to rubber; oil corrosion and solvent resistant. Used for hoses carrying oil or gasoline. gaskets, packing. pipeline rings, diaphragms, newspaper printing blankets, etc.

- - - - - - 7 8
TITANATES—General Ceramics & Steatite Corp., Keasbey. N. J. Ceramic furnished in sheet, rods tubes and plates. Abrasion resistance, high: max cont. serv. temp 1700 F: nonflammable: flexibility. low: dielectric str, 185 volts per mil: transverse str 15,000 psi: moisture absorption. low; available in straw color, opaque: sp gr 6.7. Used as dielectric material in manufacture of condensers.

1 2 3 - - - - -
TUF-FLEX—Libbey-Owens-Ford Glass Co., Toledo O. Polished plate glass heat tempered, furnished in sheet and laminated form; resists corrosion caused by moisture and all common acids except hydrofluoric acid; heat resistant to 550 F: flexibility, medium; dielectric strength 0.204 kilovolts per mil; modulus of rupture, 80,000 psi: not shatterproof but 4-5 times stronger than plate glass; produced in clear and colors: sp gr, 2.52. For machine guards observation and inspection windows, sight glasses, gage glasses, etc.

U

1 - - - - - 7 -
UFORMITE—Resinous Products & Chemical Co. Philadelphia 5. Synthetic resin adhesive, urea-formaldehyde; furnished in powder form: has low moisture absorption. high density. Used in manufacture of waterproof plywood for aircraft and marine use.

1 - 3 - 5 - - -
UNISORB—Felters Co., Boston. Specially controlled felt for vibration absorption purposes; thicknesses available for most frequencies and loadings encountered in industrial field. Also type available for sound absorption. Petroleum-resistant A special brand cement is also available for use with this material in order to eliminate the need of any other form of hold downs such as expansion bolts or lag screws Holding strength in excess of 40 psi when used between the felt and steel, concrete or wood floors.

See advertisement, Page 2̈9

1 - 3 - - - - -
U. S. RUBBER—U. S. Rubber Co., New York. A synthetic rubber for hose. belting, packing, ducts, wire and cable and vibration absorbers. Furnished in sheet, strip, rods or tubes, plate and fluid for molding, stamping or extruded. Properties to specifications desired.

1 - - - 5 - - -
"U. S." STANDARD—The United States Stoneware Co., Akron, O. Acid-proof chemical stoneware available in a wide range of shapes and sizes; resists all corrosives except hydrofluoric acid and hot caustics; for fabrication into tanks, etc., and for lining exhausters and acid-pumps. Hard, durable, available in heat-shock resistant bodies.

1 - - - 5 - 7 -
UNIVERSAL Porcelain—The Universal Clay Products Co., Sandusky, O. Ceramic-base material for molding into parts. Resists corrosion caused by acids, climatic exposure and fumes, with the exception of hydrofluoric acid heat resistant to 500 F; moisture absorption. low; available in color: sp gr. 2.3-2.5; opaque. For use in electric insulation.

1 2 - - - - - 8
USALITE 1350—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa. Ceramic furnished in extruded rods and tubes. Max cont. serv. temp. 2400 F; nonflammable; flexibility, low; ts. 7000 psi; comp str. 30,000 psi; flexural str. 5000 psi, moisture absorption, medium; available in white. opaque; sp gr, 2.3. For use in pyrometers, etc.

V

1 - - - - - - -
VICTOLENE—Victor Mfg. & Gasket Co., Chicago. Synthetic rubber compound. thermosetting material, furnished in sheets and stampings, for molding into parts; resists corrosion caused by oil. gasoline. kerosine, salt water and antifreezes; heat resistant to 250 F· flexibility, high: ts. 350 psi; moisture absorption. medium; inflammable: available in brown: shatterproof: sp gr. 1.12: opaque. For gasketing material. when compressed in position by light metal or plastic stampings, used for sealing fluids.

- 2 - 4 - - - 8
VICTOPAC—Victor Mfg. & Gasket Co., Chicago. Compressed sheet packing with asbestos base for stamping or cutting by hand into parts; high corrosion resistance: flexible: ts. 2500 psi: heat-resistant: low moisture absorption; nonflammable: impact-resistant; high compressive strength. Used for gasketing and packing.

1 2 - - - - 7 8
VICTOR—Victor Mfg. & Gasket Co., Chicago.

1 2 - - - - - 8
Asbestos sheet. asbestos-fiber base; furnished in sheets for stamping or cutting into parts. Corrosion-resistant: flexible: ts 300 psi: heat resistant to 700 F: nonflammable· sp gr, 0.9; high compressive strength: insoluble: some resilience. Used for packing. thermal insulation. and vibration absorption.

1 2 - - - - 7 -
Cork sheet; vegetable bark in sheet form for stamping and cutting into parts. Corrosion-resistant: flexible· heat resistant to 180 F; low moisture absorption: sp gr, 0.27; fair compressive strength· resilient. Used for seals, vibration absorption.

- 2 - 4 - - - -
VICTORITE—Victor Mfg. & Gasket Co., Chicago. Vegetable-fiber base sheet packing; furnished for stamping or cutting by hand into machine parts: flexible: ts. 3000 psi; heat resistant to 200 F: nonflammable; impact-resistant: sp gr. 0.675: comp str, 2000 psi; resilient. Used for gasketing and packing.

1 2 - - - - 7 -
VICTOPRENE—Victor Mfg. & Gasket Co., Chicago. Synthetic elastic. thermosetting: furnished in sheet or molded form. Sheets may be stamped and blanked into parts; corrosion and heat resistant: ts. 1500 psi; low moisture absorption; shatterproof. Used as a gasketing material.

1 - 3 - - - - -
VISTEX—American Felt Co., Glenville, Conn. Rubberized laminated felt, available in Hycar, Neoprene and Buna S types in sheets, strips or cut parts; for stamping and machining. Abrasion resistance, high. chemical resistance, as specified; max cont. serv. temp, 300 F; nonflammable; flexibility, medium; ts, 2000 psi; comp str, 10,000 psi; flexural str, high; elongation. 20 per cent; comp set, 40 per cent; moisture absorption, low; available in grey, brown. black and red; opaque. Self-lubricating positive sealing material. For hydraulic packing washers, gasketing, seals, vibration and shock mounting.

- - 3 - - - 7 -
VITALIC—Continental Rubber Works, Erie, Pa. Molded, extruded and lathe-cut mechanical rubber products including hose, fan belts, and all types of industrial rubber goods.

1 - - - - 6 - -
VITRIC-10—The United States Stoneware Co., Akron, O. Ceramic-base, nonplastic; furnished in powder form for casting into parts, or as complete parts; corrosion and heat-resistant (1000 deg F); nonflammable. Available in colors; used for cementing and sealing.

- 2 - 4 5 - - -
VULCABESTON—Colt's Patent Fire Arms Mfg. Co., Hartford. Conn. Crude and synthetic rubber and asbestos base. thermosetting. Furnished in sheet and laminated forms or rods and tubes for machining into parts or supplied as complete parts; heat resistant to 750 F: ts, 7000 psi; dielectric str, 40 volts per mil; corrosion-resistant; low moisture absorption. Uses include insulation, brake linings, packings, gaskets, etc.

- - 3 - - - - -
VULPRENE — American Resinous Chemicals Corp., Peabody. Mass. Synthetic rubber-soya, thermosetting material: furnished in sheets and powder; for molding and extruding. Abrasion resistance, low; resists corrosion caused by acids: heat resistant to 500 F: flexibility, low: ts 500-700 psi; produced in color; shatterproof; sp gr, 1.2; opaque: ages better than rubber. Used for insulation.

1 2 - - 5 - - -
VYCOR—Corning Glass Works, Corning, N. Y. Glass is approximately 96 per cent pure silica; in sheets. rods or tubes and plates; cast, molded or machined. Has high heat resistance, very low coefficient of thermal expansion. excellent corrosion resistance (except HF) and dielectric properties. Can be used at much higher temperatures than other glasses: also adaptable to high-frequency insulation. Linear coef of expansion 0.0000005 per deg F: softening point 2730 F: max cont. serv. temp. 1000 F; ts, 1000-4000 psi: comp str. 200,000 psi; sp gr. 2.23: hardness. 5.5-6.5 (Moh's) Available in opaque. transparent and ultraviolet transmitting types. For rotating seal rings, thermocouple sleeves, coil forms, etc.

W

- - 3 4 5 - - -
WELDWOOD—United States Plywood Corp., New York. Phenol-formaldehyde and urea-formaldehyde resin-bonded plywood: thermosetting: flexibility varies with thickness; splitproof: shatterproof: high tensile and dielectric strength. Obtainable in waterproof and water-resistant grades in all woods. Also available in molded shapes, tubular and curved.

- 2 - - - - - 8
WEST FELT—Western Felt Works, Chicago. Felt material: furnished in cut shapes according to user's specifications for vibration dampening, deadening sound. insulating against heat and cold and filtering liquids, air and gases: also furnished as oil or dust seals for bearings.

See advertisement, Page 144

- - 3 4 5 - - -
WILMINGTON FIBRE—Wilmington Fibre Specialty Co., Wilmington 99 Del Cotton rag and paper, chemically treated. nonplastic material; furnished in sheet form or rods

and tubes for machining or stamping into parts; dielectric str, 200-400 volts per mil; ts, 12-15,000 psi; resistant to shock and corrosion; high polish; available in colors. Used for electrical and mechanical insulation.

- - - - - - 7 -
WOODEX—Neveroil Bearing Co., Wakefield, Mass. Impregnated rock maple furnished in parts which can be machined; heat resistant to 100 F; inflammable; can be highly polished. For bearing surfaces in textile, road building, agricultural, tobacco and many other types machinery.

- - - - - - - 8
WOODITE—Syracuse Ornamental Co. Inc., Syracuse, N. Y. Molded wood; thermoplastic, furnished as molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates or decorative parts.

Z

1 2 3 - - - - -
ZIRCITE 1400—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa. Ceramic furnished in rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont. serv. temp, 2200 F; nonflammable; flexibility, high; dielectric str, 160 volts per mil; ts, 9000 psi; comp str, 80 000 psi; flexural str. 20,000 psi; moisture absorption, low; opaque; shatterproof; sp gr, 0.315. For use where high chemical, heat and impact resistance are required.

Index of Nonmetallics by Type

SUPPLEMENTING the alphabetical listing by tradenames which will be found commencing on Page 218, this index has been compiled to aid the designer in the selection of nonmetallic materials where either the tradenames are not known or it is desired to compare the properties of similar materials. Such properties are given in the alphabetical listing mentioned above. Types of materials are indexed alphabetically below, each type carrying its groupings of tradenames.

ADHESIVES

Amberlite
Penacolite G-1131
Tego
Uformite

ASBESTOS

Aztec
Stonewall (board)
Victor (sheets)

BONDING RESINS

Cardolite
Catabond
Dow Corning DC 2103
Interlake 4257
Reanite
Resin X

CARBON & GRAPHITE

Carbocell
Graphicell
Graphitar
International
Karbate
Morganite
National Carbon
Ohio
Pure Carbon
Speer
Superior

CERAMICS

Alsimag
B & W
Ceraware
Colonial
Cordierite
Firecrete
General
Hemit
Lavite
Mycalex
Stupakoff
Titanates
U. S. Standard
Universal Porcelain
Usalite 1350
Vitric-10
Zircite 1400

COMPOSITIONS

Aertite
Allymer
Armstrong's
Celite
Cellulak
Dufelt
Eel-Slip
Featherweight
Felpro
Feltan
Gaskofelt
Hy-Temp
Insulkote
National Switch
Ornametl
Phenolite
Pyroplax
Resistoflex
Ruberoid
Thermoplax
Victopac

CORKS

Armstrong's
Victor
Vistex

FELTS

American
Booth
Eagle Brand
Felters
Fidelity
"K" Felt
Resistofelt
Unisorb
West Felt

FIBERS

Brandywine
Centraline
Fabroil
Fyberoid
National
Peerless
Penn
Spaulding Armite
Spaulding Fibre
Spauldo
Victorite
Wilmington

GLASSES

Aerolite
Blue Ridge
Carrara
Duolite
Duplate
Fiberglas
Flexseal
Herculite
KGI
LOF (heat-absorbing plate)
LOF (polished plate)
Multiplate
Pennvernon
Pittsburgh
Polaroid
Pyrex
Thermopane
Tuf-flex
Vycor

LEATHERS

Armstrong's
Sirvis

MICA

Micabond

RUBBERS

Acadia
Ace
Ajax
Ameripol
Armstrong's
Butaprene
Cell-Tite
Chemigum
Cohrlastic
Conservo
General
GR-1
Hycar
Koroseal
Lord
Luzerne
Monarch
Neoprene
Perbunan
Rub-erok
Rub-tex
Silastic
Silentbloc
Sirvene
Spongex
Tensilastic
Thiokol
U. S. Rubber
Victolene
Victoprene
Vitalic
Vulcabeston
Vulprene

VARNISHES

Dow Corning DC 996
Harvel
Irvington

WOODS

American
Armorply
Dense-Tech
Densewood
Die-Tech
Farlite Compreg
Fybr-Tech
Haskelite
Jamestown
Lignum-Vitae
Pamudo
Pearl City
Phemaloid
Plastiply
Pluswood
Plycraft
Plymetl
Plymold
Ply-Tech
Preg-Tech
Pregwood
Presdwood
Resnprest
Sweet Home Brand
Syroco
Weldwood
Woodex
Woodite

Producers of Nonmetallics

A

American Felt Co., Glenville, Conn.
Felt material—"K" FELT and AMERICAN FELT
Rubberized and press laminated felt—VISTEX
Rubberized felt—FELTAN

American Hard Rubber Co., 11 Mercer St., New York.
Hard rubbers—ACE

American Lava Corp., 219 Kruesi Bldg., Chattanooga, Tenn.
Steatite ceramic—AlSiMag

American Plywood Corp., New London, Wis.
Phenolic urea plywood—AMERICAN PLYWOOD

American Resinous Chemicals Corp., Peabody, Mass.
Synthetic rubber-soya material—VULPRENE

American Wringer Co. Inc., Woonsocket, R. I.
Rubber and rubber synthetics—TENSILASTIC

Am-mex Sales Co. Inc., 28 Church St., Buffalo.
Plastic-bonded plywood—SWEET HOME BRAND

Armstrong Cork Co., Lancaster, Pa.
Cork compositions, fibrated leather, cork-and-rubber compositions, synthetic rubber compounds, rag felt papers, and cork-and-synthetic-rubber compositions — ARMSTRONG'S
See advertisement, Page 135

B

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6.
Firebrick—B&W Firebrick

Booth Felt Co., 444 19th St., Brooklyn, N. Y.
Wool base felt—BOOTH FELT

Brandywine Fibre Products Co., 14th and Walnut Sts., Wilmington, Del.
Paper-base material—BRANDYWINE FIBRE

C, D

Catalin Corp., 1 Park Ave., New York.
Phenolic plastic—CATABOND

Central Paper Co. Inc., 2400 Lakeshore Drive, Muskegon 28, Mich.
Wood-cellulose fiber material—CENTRALINE

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago.
Synthetic rubber compounds—SIRVENE
Heat-resisting leather—SIRVIS

Colonial Insulator Co., The, 973 Grant St., Akron, O.
Ceramic material—COLONIAL CERAMICS

Colt's Patent Fire Arms Mfg. Co., 17 Van Dyke Ave., Hartford, Conn.
Hard rubber and asbestos base material—VULCABESTON

The Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.
Silicone elastomer on fiberglas—COHRLASTIC

Continental-Diamond Fibre Co., Newark, Del.
Shellac thermosetting material—CELLUPAK
Mica material—MICABOND

Continental Rubber Works, 1902 Liberty St., Erie, Pa.
Mechanical rubber—VITALIC

Corning Glass Works, Corning, N. Y.
Glass material—PYREX and VYCOR

Cutler-Hammer Inc., 12th and St. Paul, Milwaukee.
Bituminous plastic—THERMOPLAX
Asbestos base material—PYROPLAX

Densewood Corp., The, Elkhorn, Wis.
Impregnated wood—DENSEWOOD

Dow Corning Corp., Midland, Mich.
Electrical insulating varnish—DOW CORNING DC 996
Silicone rubbers—SILASTIC
Silicone bonding resin—DOW CORNING DC 2103

Du Pont de Nemours, E. I., & Co., Inc., Wilmington 98, Del.
Chloroprene rubber—NEOPRENE
See advertisements, Pages 272, 317

F

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Wood veneers, laminated and impregnated—FARLITE COMPREG

Felt Products Mfg. Co., 1508 Carroll Ave., Chicago 7.
Felt for vibration isolation, etc.—UNISORB Chicago 7.
Fiber, rubber, cork and felt material—FEL-PRO
See advertisement, Page 280

Felters Co., 210 South St., Boston.
Felt for vibration isolation, etc.—UNISORB and EAGLE BRAND
Felt for grease and oil retention—FELTERS FELT and DUFELT
See advertisement, Page 259

Fidelity Felt & Mfg. Co., Front & Venango Sts., Philadelphia 40.
Felt—FIDELITY Felt

Firestone Tire & Rubber Co., Akron, O.
Synthetic rubber—BUTAPRENE

Formica Insulation Co., 4613 Spring Grove Ave., Cincinnati, O.
Phenolic impregnated wood—PREGWOOD
See advertisement, Page 270

G

Gatke Corp., 228 N. La Salle St., Chicago 1.
Asbestos packing—AZTEC

General Ceramics Co., 30 Rockefeller Plaza, New York.
Ceramic material—CERAWARE

General Ceramics & Steatite Corp., Keasbey, N. J.
Ceramic material—STEATITE GENERAL Aluminum Oxide, CORDIERITE and TITANATES

General Electric Co., 1 Plastics Ave., Pittsfield, Mass.
Ceramic base—MYCALEX
Fiber material—FABROIL
See advertisement, Page 303

General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.
Natural and synthetic rubber combined with metal—SILENTBLOC
Rubber—GENERAL

Goodrich, B. F., Co., Akron, O.
Synthetic rubbers—AMERIPOL and KOROSEAL

Goodrich Chemical Co., B. F., Rose Bldg., Cleveland.
Synthetic rubber—HYCAR
See advertisement, Page 142

Goodyear Tire & Rubber Co., Akron, O.
Synthetic rubber—CHEMIGUM

H

Haskelite Mfg. Corp., Grand Rapids 2, Mich.
Resin-bonded plywood—HASKELITE, PLYMOLD, PLASTIPLY and PHEMALOID
Lignin enriched press paper base—LIGNOLITE
Wood veneer on steel—ORNAMENTL and PLYMETL
See advertisement, Page 276

Hewitt Rubber of Buffalo, Div. Hewitt-Robins Inc., 240 Kensington Ave., Buffalo 5.
Rubber—MONARCH, AJAX and CONSERVO

I

Interlake Chemical Corp., Union Commerce Bldg., Cleveland 14.
Phenolic liquid glue—INTERLAKE 4257

International Graphite & Electrode Corp., St Marys, Pa.
Graphite electrodes—INTERNATIONAL

Irvington Varnish & Insulator Co., Irvington, N. J.
Insulating varnishes—IRVINGTON and HARVEL
Resins—CARDOLITE

J, K

Jamestown Veneer & Plywood Corp., Box 581G, Jamestown, N. Y.
Plywood—JAMESTOWN

Johns-Manville, 22 E. 40th St., New York 16.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material—AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Refractory material—FIRECRETE

Keasbey & Mattison Co., Ambler, Pa.
Asbestos materials—HY-TEMP and FEATHERWEIGHT

Kopp Glass Inc., Swissvale, Pa.
Industrial glass—KGI

L

Lenoxite Div., Lenox Inc., 65 Prince St., Trenton, N. J.
Ceramic insulating material—LENOXITE

Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
Figured and wire glass—BLUE RIDGE
Polished plate glass—TUF-FLEX and LOF
Glass with metal edge seal—THERMOPANE
Heat-absorbing plate glass—L-O-F

Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.
Tropical wood—LIGNUM-VITAE

Lord Mfg. Co., Erie, Pa.
Bonded rubber—LORD
See advertisement, Page 149

Luzerne Rubber Co., Dewey St., Trenton, N. J.
Hard rubber, thermoplastic—LUZERNE HARD RUBBER

M

Marathon Chemical Co., Div. of Marathon Paper Mills Co., Rothschild, Wis.
Lignin plastic—LIGNOLITE

Masonite Corp., 111 West Washington St., Chicago.
Wood fiber board—PRESDWOOD

Morganite Brush Co. Inc., 3302 48th Ave., Long Island City, N. Y.
Carbon-graphite—MORGANITE
See advertisement, Page 158

N

National Carbon Co. Inc., 30 E. 42nd St., New York 17.
Carbon or graphite in amorphous or graphitic form—NATIONAL CARBON
Porous graphite—GRAPHICELL
Porous carbon—CARBOCELL
Carbon-graphite base impervious material—KARBATE

National Vulcanized Fibre Co., Wilmington, Del.
Laminated Bakelite—PHENOLITE
Cotton cellulose base, vulcanized fiber—NATIONAL FIBRE, NATIONAL SWITCH INSULATION
Cotton-rag base, fish-paper insulation—PEERLESS
See advertisement, Page 269

Neveroil Bearing Co., Wakefield, Mass.
Impregnated maple bearings—WOODEX

O, P

Ohio Carbon Co., 12508 Berea Rd., Cleveland 11.
Carbon and carbon graphite—OHIO Carbon

Owens-Corning Fiberglas Corp., Toledo, O.
Glass, in fiber form—FIBERGLAS
See advertisement, Page 164

Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash.
Plywood—PAMUDO Plywood

Pearl City Plywood Co. Inc., Allen St. Ext., Jamestown, N. Y.
Plywood and veneer—PEARL CITY Plywood

Penn Fibre & Specialty Co., 2030 E. Westmoreland St., Philadelphia 34.
Paper base material—PENN Fibres

Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19.
Heat-treated plate glass—HERCULITE, PENN-VERNON, CARRARA and PITTSBURGH PLATE
Laminated plate glass—DUPLATE, DUOLITE, AEROLITE, MULTIPLATE and FLEXSEAL
Allyl resin monomers—ALLYMER

Pluswood Inc., Oshkosh, Wis.
Resin-impregnated plywood—PLUSWOOD

Plylock Corp., subsidiary of M & M Wood Working Co., Portland, Ore.
Phenol-formaldehyde bonded exterior plywood—RESNPREST

Polaroid Corp., Cambridge, Mass.
Light-polarizing glass—POLAROID

The Porcelain Insulator Corp., Lima, N. Y.
Ceramic base material—PINCO Porcelain

Pure Carbon Co. Inc., 441 Hall Ave., St. Marys, Pa.
Pure carbon—PURE CARBON
See advertisement, Page 318

R

Resinous Products & Chemical Co., 222 West Washington Sq., Philadelphia 5.
Plastic bonded plywoods—AMBERLITE, TEGO and UFORMITE

Resistoflex Corp., Belleville, N. J.
Synthetic resin base—RESISTOFLEX

Richardson Co., The, Melrose Park, Ill.
Hard rubber—RUB-TEX and RUB-EROK
See advertisement, Page 162

Ruberoid Co., 500 Fifth Ave., New York 18.
Asbestos cement board—STONEWALL
Insulating tape—RUBEROID

S

Snedaker, Frank C., & Co. Inc., 9th and Tioga Sts., Philadelphia 40, Pa.
Resin-bonded plywood—PLYCRAFT

Spaulding Fibre Co. Inc., Tonawanda, N. Y.
Fibre material—SPAULDING FIBRE, SPAULDING ARMITE and SPAULDO

Speer Carbon Co., St. Marys, Pa.
Carbon and graphite—SPEER Carbon

Sponge Rubber Products Co., Shelton, Conn.
Hard and soft rubber—CELL-TITE
Sponge rubber—SPONGEX

Stanco Distributors Inc., 26 Broadway, New York 4.
Synthetic rubbers—GR-I BUTYL and PERBUNAN

Steward Mfg. Co., D M., Chattanooga 1, Tenn.
Ceramic—LAVITE

Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Steatite ceramic—STUPAKOFF Nos. 621 and 1100, ZIRCITE 1400 and USALITE 1350

Superior Carbon Products Inc., 9115 George Ave., Cleveland 5.
Carbon—SUPERIOR Carbon
See advertisement, Page 312

Syracuse Ornamental Co. Inc., Syracuse, N. Y.
Molded wood—SYROCO and WOODITE

T

Technical Ply-Woods, 228 N. LaSalle St., Chicago 1.
Plywoods—DENS-TECH, DIE-TECH, FYBR-TECH, PLY-TECH and PREG-TECH

Thiokol Corp., Trenton, N. J.
Synthetic rubber—THIOKOL

U

United States Graphite Co., Saginaw, Mich.
Carbon-graphite—GRAPHITAR
See advertisements, Pages 147, 160-161

United States Plywood Corp., 55 West 44th St., New York.
Resin-bonded plywood—WELDWOOD
Metal-covered plywood—ARMORPLY

U. S. Rubber Co., 1230 Sixth Ave., New York.
Synthetic rubber—U. S. RUBBER

United States Stoneware Co., Akron, O.
Chemical Stoneware—"U. S." STANDARD
Ceramic, nonplastic—VITRIC-10
Resinous thermosetting—REANITE

Universal Clay Products Co., The, Sandusky, O.
Ceramic material—UNIVERSAL PORCELAIN

V

Victor Mfg. & Gasket Co., 5750 Roosevelt Rd., Chicago.
Compressed sheet packing—VICTOPAC
Vegetable fiber base sheet packing—VICTORITE
Asbestos sheet—VICTOR
Cork sheet—VICTOR
Compounded synthetic rubber—VICTOPRENE
Synthetic rubber—VICTOLENE

W

Western Felt Works, 4117 Ogden St., Chicago.
Felt material—WESTFELT, GASKOFELT and RESISTOFELT
Synthetic rubber—ACADIA
See advertisement, page 144

Westinghouse Electric Corp., Derry, Pa.
Ceramic base—PRESTITE

Wilmington Fibre Specialty Co., Wilmington, Del.
Paper base material—FYBEROID
Cotton rag and paper, nonplastic—WILMINGTON FIBRE

Stampings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of stampings; (b) Names of stamped machine parts customarily produced; and (c) Machining, heat-treating or assembling facilities

A

Accurate Spring Mfg. Co., 3811 W. Lake St., Chicago 24.

(a) Blanking, forming and perforating all metals, small and medium sizes, specializing in spring materials.
(b) To customers' specifications.
(c) Complete facilities.

Ace Mfg. Corp., 1201 E. Erie Ave., Philadelphia.

(a) Blanking, forming and extruding, in pieces 8-12 in. in size, to 75-ton pressure and 2 in. depth of draw.
(b) To customers' specifications.
(c) Machining and grinding.

Acklin Stamping Co., The, 1927 Nebraska Ave., Toledo 7, O.

(a) Flat, drawn, formed stampings of steel, aluminum, brass, copper, Monel, clad materials etc., up to approx 30 in. diam and 12 in. deep, from metals .015-.500 in. thick.
(b) Parts for household appliances, automobiles, agricultural, electrical equipment, etc.
(c) Machining and welding.

Acme Mfg. & Gasket Co., 738-40 N. 41st St., Philadelphia 4.

(a) Flat stampings in steel, brass, copper, lead and other metals.
(b) Washers, shims, punches and dies, etc.
(c) Information not available.

Adams, S. G., Metalware Co., 2947 Delmar Ave., St. Louis.

(a) Flat, drawn and formed stampings in steel, brass, copper, stainless steel, Monel, Inconel· 12 gage and lighter to 5 in. deep x 30 x 60 in.
(b) To customers' specifications.
(c) Finishing facilities.

Adell Corp., 61 East River St., Orange, Mass.

(a) Flat, drawn and formed stampings, in hot and cold rolled steel, brass and stainless, to 3/16-in. thick.
(b) Parts for universal joints, oil burner accessories textile measuring devices, water heaters, etc.
(c) No information available.

Akron-Selle Co., The, 451 S. High St., Akron 11, O.

(a) Flat drawn and formed stampings; in steel, brass and aluminum; 24 in. max diam, 4¾ in. max depth and 3/16 in. thick, depending on size of piece.
(b) To customers' specifications.
(c) Machining and welding.

Alofs Mfg. Co., 1615 Madison Ave., S. E., Grand Rapids 7, Mich.

(a) Flat, drawn and formed stampings in steel, stainless, brass and aluminum. Drawn, 2 in. deep; formed, 60 tons pressure or less.
(b) Automotive and other miscellaneous parts.
(c) Complete facilities.

Alto Mfg. Co., 1647 Wolfram St., Chicago 13

(a) Flat, drawn, formed steel stampings. Drawn shapes, max depth 3¾ in., bolster size, largest press 27 x 40 in.
(b) To customers' specifications.
(c) Facilities for small assemblies.

Aluminum Goods Mfg. Co., Washington St., Manitowoc, Wis.

(a) Stampings, spinnings and deep drawings in aluminum, stainless steel and other metals.
(b) Refrigerator, radio, textile, electrical, airplane and automotive parts.
(c) Machining, heat-treating, welding.

American Aluminum Ware Co., 366-378 Jelliff Ave., Newark 8, N. J.

(a) Stampings, drawings and spinnings of aluminum.
(b) To customers' specifications.
(c) No information available.

American Central Mfg. Corp., Connersville, Ind.

(a) Flat, drawn and formed stampings of hot and cold rolled steel, vitreous enameling, stainless steel and aluminum. All up to 10 ft long.
(b) To customers' specifications.
(c) Complete facilities.

American Emblem Co. Inc., Cayuga Square, Utica, N. Y.

(a) Art metal and intricate stampings up to 16 in. square; .003 to .25-in. metal thickness.
(b) Embossed nameplates, radio escutcheons and dials and ornamental trim and stampings.
(c) Complete facilities.

American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29.

(a) Pressed steel stampings in light to heavy steel gages; also deep drawn stampings.
(b) To customers' specifications.
(c) Complete facilities.

American Stamping Co., Battle Creek, Mich.

(a) Flat, drawn and formed stampings in all metals; small and medium. Extra deep drawing a specialty.
(b) Grease cups oil cups, and automotive, radio and aircraft parts.
(c) Complete facilities.

American Stamping Co., The, 978 E. 64th St., Cleveland 14.

(a) Flat, drawn and formed stampings mainly in steel; in various sizes.
(b) Automotive parts, brake backing plates, etc.
(c) None.

Amesbury Metal Products Co., 39 Oakland St., Amesbury, Mass.

(a) Flat, drawn and formed stampings, in brass, copper, nickel, steel and aluminum, in all sizes.
(b) Automotive and marine parts.
(c) Complete facilities.

Anderson Co. Inc., O. L., 1347-87 Fort St., East, Detroit 7.

(a) Flat, formed and drawn (to 5 in.) stampings in steel. Presses up to 38 x 122 in.
(b) Automotive.
(c) Assembling facilities.

Angell Mfg. Co., P. O. Box 583, Dayton 1, Ohio.

(a) Embossed, flat, drawn and formed stampings in brass, aluminum, steel and zinc; 8 x 4 in. max.
(b) Embossed metal nameplates, labels, seals, etc.
(c) Machining and finishing facilities.

Auburn Shank Co., 7 Columbus St., Auburn, N. Y.

(a) Flat, shallow drawn in small size, and formed stampings in steel and brass. Max. sizes, approx 5 in. in diam, approx 8 in. in length strips and approx ⅛ in. in thickness.
(b) Steel shoe shanks, pressure levers for automotive clutches, inserts, clamps, housings, etc. for automotive ignition parts.
(c) Heat-treating facilities.

Auto Sun Products Co., The, 529 Poplar St., Cincinnati 14.

(a) Flat, drawn and formed stampings, 30 gage to 5/16 in. thick, to 12 in. in diam.
(b) Radio, refrigerator, automotive, washing machine parts, etc.
(c) Assembling, plating, painting, electric spot welding.

B

Baker Co., The W. J., Newport, Ky.

(a) All types of stampings and forming of metal and wire up to 14 in gage thickness, within about 20 x 25 in. in outside perimeter.
(b) To customers' specifications.
(c) No information available.

Banner Die, Tool & Stamping Co., 1300 Holly Ave., Columbus 8, O.

(a) Drawing, forming, blanking, piercing, trimming of steel, brass, copper and aluminum; small to medium.
(b) Miscellaneous machine parts.
(c) None.

Barnes-Gibson-Raymond Div., Associated Spring Corp., 6391 Miller Ave., Detroit. (The Cook Plant—Ferry Field and Boulevard drive, Ann Arbor, Mich.)

(a) Small flat springs and stampings from carbon and alloy steels and nonferrous metals.
(b) Special small stampings, formed flat wire parts, catches, clips, contacts, snap rings, retainers and washers.
(c) Complete facilities.

Barth Mfg. Co., 1826 Columbus Rd., Cleveland, O.

(a) Small and medium (120 ton press largest) flat, pierced, drawn and formed stampings of steel, aluminum, brass, copper and stainless steel.
(b) Electrical and refrigerator parts, etc.
(c) Machining and assembling facilities.

Behringer Metal Works Inc., 108-122 Jabez St., Newark 5, N. J.

(a) Flat, drawn, formed, etc., of steel, brass, aluminum and stainless steel; to 24 x 48 in. in size. Formed sections to 20 ft long.
(b) Miscellaneous, to customers' specifications.
(c) Complete facilities.

Boehm Pressed Steel Co., The, 2219 W. 63rd St., Cleveland 2.

(a) Flat, drawn and formed stampings in steel, brass, copper, aluminum and stainless steel in small and medium sizes.
(b) To customers' specifications.
(c) None.

Bossert Co. Inc., The, 1002 Oswego St., Utica, N. Y.

(a) Stampings from .005 to 1 in. in thickness, in any metal.
(b) Parts for automotive, refrigeration, washing machine, radio industries, etc.
(c) Assembling and welding facilities.

Bowen Products Corp., Auburn Div., Auburn, N. Y.

(a) Flat, deep drawn and formed stampings in steel, copper, brass, nickel and silver; also coined parts. Deep drawn, to 4 in. in diam x 6½ in. long, coined parts, to ½ in. in thickness.
(b) Grease cups, oil cups, centralized oiling systems and special stampings of all types.
(c) Machining and assembling facilities.

Brewer-Titchener Corp., The, 111 Port Watson St., Cortland, N. Y.

(a) Flat, formed, and drawn stampings of ferrous and nonferrous metal, stainless, etc., up to 30 x 60 in. in size and 4 in. max draw.
(b) To customers' specifications.
(c) Complete facilities.

Bridgeport Chain & Mfg. Co., The, Bridgeport, Conn.

(a) Small, flat stampings of steel, brass and bronze, to .065 in. gage, 4 in. length or diam.
(b) To customers' specifications.
(c) Complete facilities.

Buckeye Stamping Co., The, 555 Marion Rd., Columbus 7, Ohio.

(a) Seamless flat, deep drawn and formed stampings in tin plate, black plate, aluminum and steel, about 18 gage and lighter. Sizes for drawn, to 6 in. in diam.; for flat, approx. to 10-12 in. x 6-8 in.
(b) Light metal stampings of all types.
(c) Machining facilities.

Budd Co., The, Wheel Division, 12141 Charlevoix Ave., Detroit 14.

(a) Flat, drawn and formed stampings of plate, strip and sheet steel, up to approx. 36 in. in diam.
(b) Wheel disks, brake backing plates, brake parts, brake drum backs, etc., for automobiles, trucks and trailers.
(c) Complete facilities.

Budd Co., The, Philadelphia 32, Pa.

(a) Automobile body and large and small special stampings of mild and stainless steels.
(b) Automotive, process industries, railway passenger cars commercial truck trailers, marine and aircraft parts.
(c) Complete facilities.

Burgess-Norton Mfg. Co., Geneva, Ill.

(a) Steel stampings to .35 carbon; flat drawn to 3 in. and formed (press operations from 10-150 tons—largest bed plate 24 x 24 in.).
(b) Farm and automotive equipment, washing machine, lawn mower and refrigerator parts.
(c) Complete facilities.

By-Products Steel Corp., Coatesville, Pa.

(a) Flat plates pressed, bent, sheared or blanked, and flame-cut steel shapes, in thicknesses from $\frac{3}{16}$ in. up.
(b) To customers' specifications.
(c) Complete facilities.

C

Chandler Co., 1407 Park St., Hartford 6, Conn.

(a) Flat, drawn and formed; etched, lithographed and engraved stampings, of aluminum, brass, steel bronze, zinc, tin, and nickel silver, up to .062 in. thick and 9 in. diam.
(b) Nameplates, dials, escutcheons, panels, etc.
(c) Assembling facilities.

Chase Brass & Copper Co. Incorporated, 236 Grand St., Waterbury 91, Conn.

(a) All types sheet metal stampings, drawn shells of brass, copper and copper alloys.
(b) All types of parts.
(c) Machining, polishing, plating and assembling facilities.

City Auto Stamping Co., Lint and Dura Ave., Toledo, O.

(a) Large light-gage stampings.
(b) Automotive tractor and refrigerator parts.
(c) Assembling facilities.

Cleveland Steel Products Corp., Plant No. 2, Wellington, O.

(a) All types to 12 in. draw, 12 in. diam, ¼ in. thick.
(b) Automotive, industrial and electrical.
(c) Complete secondary operation, cyanide hardening, plating and assembling.

Columbia Metal Stamping Co., The, 11900 Harvard Ave., Cleveland.

(a) Light and medium stampings in all metals to ¼ in. thick, to 24 x 24 in. Deep drawn to 3½ in. deep, ⅛ thick.
(b) Automotive, electrical, industrial and general.
(c) Complete facilities.

Commercial Shearing & Stamping Co., 1775 Logan St., Youngstown, O.

(a) To 60 in., ¾-in. gage, steel and copper alloys, aluminum and stainless steel.
(b) Tank heads and water heater parts.
(c) Machining and assembling facilities.

Continental Machines Inc., Savage, Minn.

(a) Flat, drawn, pierced and formed stampings in aluminum, brass, copper and steel, to 16 in. sq and 1¼ in. deep.
(b) To customers' specifications.
(c) Complete facilities.

Cook Co., The H. C., 28 Beaver St., Ansonia, Conn.

(a) Flat and formed stampings in steel, brass, aluminum, zinc copper and nickeloid; small and medium sizes.
(b) To customers' specifications.
(c) Complete facilities.

Croessant Machine Works, 39-41 Moss St., Reading, Pa.

(a) Light sheet metal stampings in all materials, up to 60 tons.
(b) To customers' specification.
(c) Information not available.

Crosby Co., 183 Pratt St., Buffalo 5.

(a) All types of stampings in steel, brass, copper, aluminum, etc., in any size.
(b) To customers' specifications.
(c) Complete facilities.

Croname, Incorporated, 3701 Ravenswood Ave., Chicago 13.

(a) Flat, drawn and formed stampings in brass, bronze, steel, aluminum and zinc; sizes made to customers' specifications.
(b) Metal cabinets, panels and various machine parts.
(c) Complete facilities.

Cuyahoga Spring Co., The, 10301 Berea Rd., Cleveland.

(a) Stampings of cold-rolled steel, up to No. 10 gage; flat springs stamped or formed and tempered for mechanical purposes; also brass bronze stainless steel and beryllium copper stampings.
(b) Primarily flat springs.
(c) Complete facilities.

D, E

Dahlstrom Metallic Door Co., Buffalo St., Jamestown, N. Y.

(a) Steel, stainless steel, brass, bronze, aluminum stampings and drawn parts. Press equipment Bliss 3-B to 8-E. Toledo press (bed 88 in. x 44 in.), brake presses for sections 10 to 12 ft long.
(b) Machine guards, cabinets, brackets and special parts.
(c) Assembling facilities.

Davis Brake Beam Co., Johnstown, Pa.

(a) Flat, drawn and formed stampings, principally of steel. Blanked and flat formed 16 x 24 x 12 in. gage; formed and drawn and hot pressed 16 x 16 x 9 in. gage, requiring not over 200 tons pressure.
(b) Steel legs and base units for stoves, refrigerators and institutional equipment; also metal stool (round) seats. Springs from bar stock.
(c) Limited facilities.

Dayton Rogers Mfg. Co., 2835 12th Ave., Minneapolis 7.

(a) Stampings of steel, brass, copper and other sheet alloys, as well as bakelite and similar synthetics.
(b) Metal stampings in small lots for all industries including aircraft, radio, instruments, electrical, etc.
(c) Heat treating and deburring.

Dellinger Mfg. Co., 725 N. Prince St., Lancaster, Pa.

(a) Flat and formed; of steel, copper, and aluminum; to fit presses up to 100-ton capacity with bottom area of 30 x 40.
(b) Electric controller parts, radio, etc.
(c) Assembling and welding facilities.

Detroit Stamping Co., 350 Midland Ave., Detroit 3.

(a) Flat, drawn to 2½ deep, formed, coined; of steel and alloys, annealed and tempered, and nonferrous metals; small and medium, to 2 x 3 ft.
(b) Pressed metal parts for all types of machines; spacers, shims, washers, etc.
(c) Light machining and assembling.

Dickey-Grabler Co., 10302 Madison Ave., Cleveland.

(a) Metal stampings. 20-150 ton presses.
(b) Various machine parts.
(c) Assembling, induction welding, finishing.

Dunbar Brothers Co., Div. of Associated Spring Corp., Bristol, Conn.

(a) Flat and formed stampings of spring steel, stainless and other alloys in small sizes.

(b) To customers' specifications.

(c) Heat-treating facilities.

Eastern Tool & Stamping Co. Inc., 110 Ballard St., Saugus, Mass.

(a) Flat, deep drawn and formed stampings in steel, brass, copper, aluminum, nickel and zinc; small, medium and large sizes.

(b) Electrical, textile, automotive, radio parts, etc.

(c) Heat-treating and welding facilities.

Eaton Mfg. Co. Stamping Div., 755 E. 140th St., Cleveland.

(a) All type stampings, excepting long draws; of steel, brass and aluminum: in small and medium sizes (to 15-inch blank).

(b) Gas, oil and radiator caps and necks, etc.

(c) Trimming, facing, threading, plating, assembling.

Emsco Auto Products Corp., 33 34th St., Brooklyn, N. Y.

(a) Flat, drawn and formed stampings in all metals up to $\frac{3}{16}$ in. in thickness; sizes of stampings up to 20 x 24 in.

(b) To customers' specifications.

(c) Assembling and finishing.

Erie Art Metal Co., 18th & Schaal Ave., Erie, Pa.

(a) Flat and formed stampings, press brake shapes, 10 ft; other stampings, 125 ton press.

(b) To customers' specifications.

(c) Welding, assembling and finishing facilities.

Eureka Tool & Machine Co., 17 W. 54th St., New York.

(a) Small and medium stampings.

(b) To customers' specifications.

(c) Complete facilities.

Evans, George, Corp., The, 121 37th St., Moline, Ill.

(a) Flat, drawn and formed stampings in steel, brass and aluminum; sizes of stampings to $\frac{3}{16}$ in. in thickness, 4 ft in width, and 12 in. in depth.

(b) Automotive, farm equipment and communication equipment parts.

(c) Complete facilities.

F, G

Falstrom Co., Falstrom Court, Passaic, N. J.

(a) Fabricated steel parts of all kinds.

(b) Machine bases, frames, guards, instrument panels, etc.

(c) Machining and assembling facilities.

Faries Mfg. Co., Decatur, Ill.

(a) Flat, drawn and formed stampings in brass, steel and aluminum; medium sizes up to 15 in. in diam and 10 in. deep, from .010 to .050 thick.

(b) Various machine parts.

(c) Machining, assembling and finishing.

Firestone Steel Products Co., Akron, O.

(a) Flat, drawn, formed, etc.; carbon and alloy steels; small, medium and large.

(b) Automotive, washing machine and conveyor parts, etc.

(c) Complete facilities.

Fox Co., Fox Bldg., Cincinnati

(a) Metal stampings.

(b) Nameplates, escutcheons, etc.

(c) Assembling facilities.

G G G Metal Stamping Co., Inc., Warren, Pa.

(a) Flat, formed and drawn stampings in all types of metals to ¼ in. thick material. Largest press, 80 tons.

(b) Blue print dryers, domestic, fire and farm equipment, etc.

(c) Complete facilities.

General Metal Products Co., 3883 Delor St., St. Louis 16.

(a) All types of flat, drawn, formed stampings; in steel, stainless brass, aluminum, etc.; small, medium and large.

(b) To customers' specifications.

(c) Machining and heat treating.

Geometric Stamping Co., The, 1108 E. 200th St., Cleveland.

(a) Any type stampings in steel, stainless steel, brass, etc., ½ in. thick, 48 x 48 in.

(b) Dairy, washing machine, radio, railroad, automobile parts and assemblies.

(c) Complete facilities.

Geuder, Paeschke & Frey Co., 324 N. 15th St., Milwaukee.

(a) Deep drawn in all metals to 48 in. diam 18 in. deep, 12-30 gage.

(b) Government sheet metal work.

(c) Complete facilities.

Gibson Co., William D., Div. of Associated Spring Corp., 1800 Clybourn Ave., Chicago.

(a) Miscellaneous stampings of cold-rolled spring steel, stainless and alloys, small and medium.

(b) Springs, all flat including Bellville.

(c) Heat-treating facilities.

Globe Stamping Div., Hupp Motor Car Corp., 1250 W. 76th St., Cleveland.

(a) Metal stampings of all sizes.

(b) Stamping assemblies, tumbling and burnishing barrels.

(c) Machining and assembling facilities.

Goat Metal Stampings Inc., 314 Dean St., Brooklyn 17.

(a) Small, flat, drawn, formed, blanks, etc.; of stainless steel, nickel, monel, copper alloys, tin plate, aluminum, etc.; from .002 to ⅛-in. thick, generally under 2 in. wide, max 6 x 12 in.

(b) Electronic parts.

(c) Proper facilities for light work.

Grammes, L. F., & Sons Inc., Allentown, Pa.

(a) Stampings of brass, aluminum, steel, etc.

(b) Automotive, radio, clock and electrical.

(c) Complete facilities.

Gray, Peter, Corp., 290 Third St., Cambridge, Mass.

(a) Steel and nonferrous metals, drawn, stamped and formed, up to $\frac{3}{16}$ in. thick; 4 to 400 ton presses with bed areas up to 25 sq ft. Power and hand brakes for 10-gage material by 8 ft long.

(b) Handles, guards, stop motions, meters, fans, covers, radio, refrigerator clock casings, propeller heads, and textile machine parts.

(c) Assembling, spotwelding, finishing, riveting and soldering.

Gregory Mfg. Co., 67 Franklin St., New Haven, Conn.

(a) Formed and drawn stampings of brass, steel, copper and aluminum. Maximum depth of draw 1¼ in.; small to medium sizes— max blank 10 x 10 in.

(b) Electric knife switches, spring tension washers, etc.

(c) Complete facilities.

Greist Mfg. Co., The, New Haven 15, Conn.

(a) Small stampings, specializing on forming operations.

(b) Business machine, photographic, electrical, sewing machine attachments and assemblies.

(c) Complete facilities.

Griffith-Hope Co., 6607 W. Mitchell St., West Allis, Wis.

(a) Formed and drawn shapes; 5 in. max depth.

(b) All types of stampings.

(c) Welding, enameling, assembling.

Guarantee Specialty Mfg. Co., The, E. 96th St., Cleveland.

(a) Flat and drawn stampings, drawing not exceeding 4 in. deep; of sheet steel, band iron, sheet and coil brass, copper, bronze and aluminum in small and medium sizes.

(b) Washers, shims, airplane washers, etc.

(c) Heat treating, plating and finishing.

Guth, Edwin F., Co., 2615 Washington Ave., St. Louis 3.

(a) Flat (die punched), deep drawn (12-15 in. deep), and die formed (channels, etc.); of steel, brass, aluminum, copper and stainless steel; in 30-in. diam to less than an inch in size. Also spinning.

(b) Switch parts, fan blades, fabricators, etc.

(c) Machining, assembling and finishing.

H, I, J

HPL Manufacturing Co., 2013 E. 65th St., Cleveland 3.

(a) Flat, formed and drawn stampings, in any material which can be fabricated in cold state. Max 16 x 14 in., max tonnage 70 ton. Max draw 2 in. less thickness of stock.

(b) To customers' specifications.

(c) None.

Hendrick Mfg. Co., Dundaff St., Carbondale, Pa.

(a) Forming, flanging and perforating, of steel, stainless, nonferrous metals, plastics, fiber, rubber, paper, etc.

(b) All types of cold-worked machine parts

(c) Complete facilities.

Hershey Metal Products, Derby, Conn.

(a) Flat, formed, and shallow drawn stampings, of carbon and alloy steels, and copper base alloys; ¼ in. thick by 7 in. wide.

(b) Laminations, contacts, etc.

(c) Screw machining.

Heyman Mfg. Co., Michigan Ave., Kenilworth, N. J.

(a) Blanked and formed stampings of strip steel, brass, copper and aluminum; to $\frac{3}{16}$ in. thick and 6 in. long.

(b) Electrical contacts and aircraft brackets

(c) None.

Hubbard, M. D., Spring Co., Pontiac, Mich.

(a) Small stampings in spring steels, hot and cold-rolled steel, brass, bronze, aluminum, Monel and stainless steel.

(b) Expansion plugs, washers, flat springs and spring washers.

(c) Drilling, tapping, spot welding, and heat treating.

Hunter Pressed Steel Co., Lansdale, Pa.

(a) All types, small and medium; max 15 in. blank, $\frac{1}{16}$ in. stock.

(b) Mechanical coil springs and wire forms.

(c) Complete facilities.

Illinois Stamping & Mfg. Co., 220 N. Jefferson St, Chicago 6.

(a) Flat, formed and drawn stampings, in steel, brass and copper. Presses from 1 to 5 lb, 2½ in. stroke.

(b) Sprayers, spindle ends, carburetor parts, etc.

(c) None.

Indiana Pressed Steel Co., Muncie, Ind.

(a) Medium and medium-large stampings in all metals.
(b) Refrigerator, automotive, radio, electrical, etc.
(c) Complete facilities.

Johnson Sheet Metal Works Corp., 620 S. J St., Richmond, Va.

(a) Drawn, formed stampings, also shearing, piercing and braking, primarily of steel, up to 10 gage thick, and to approx 42 x 112 in size.
(b) Hoods, fender shells, instrument panels, hinges, and miscellaneous truck and bus parts.
(c) Assembling, spot and arc welding.

K

Kees, F. D., Mfg. Co., 24 High St., Beatrice, Neb.

(a) Flat, drawn and formed stampings of light and medium gage in steel, brass, aluminum, copper and zinc; presses to 80 tons x 4 in. stroke, and 50 tons x 5½ in. stroke.
(b) Electrical, radio and miscellaneous parts.
(c) Welding, riveting and machining facilities.

Kickhaefer Mfg. Co., 901 S. Second St., Milwaukee.

(a) Small and medium stampings of steel, brass, copper and aluminum.
(b) Valve spring washers, special washers, tubing and wire clips, engine front and rear plates, plugs, etc.
(c) None.

Kirk & Blum Mfg. Co., The, 2850 Spring Grove Ave., Cincinnati, O.

(a) Special pressed metal stampings. Presses up to 36 x 84 in., 12 in. stroke; press brakes to 16 ft to 10 in., 600 tons capacity.
(b) Machine bases, pedestal, guards, lathe pans, truck body and cab parts.
(c) Assembling and welding facilities.

Klein Mfg. Co., Burlington, Ia.

(a) Steel and galvanized iron stampings.
(b) To customers' specifications.
(c) Complete facilities.

Klopping, The. Stamping Co., 1678 Norwood Ave., Toledo 7, O.

(a) Flat, drawn and formed stampings of steel, brass, aluminum and stainless steel; gage .031 to .50, sizes to 32 x 32 in.
(b) Automotive parts.
(c) Information not available.

Knott, A. J., Tool & Mfg. Corp., 6 Front St., Milford, Mass.

(a) Medium and light metal stampings; in all types of steel, brass, phosphor bronze, aluminum and nickel-silver.
(b) To customers' specifications.
(c) Heat-treating and assembling facilities.

Konigslow, Otto, Mfg. Co., 3610 Perkins Ave., Cleveland.

(a) Flat, drawn, pierced and formed stampings of steel, brass, copper, aluminum, stainless steel, etc.; small and medium sizes.
(b) All types of parts.
(c) Machining facilities.

L

LaGanke & Sons Stamping Co., 864 E. 140th St., Cleveland.

(a) Blanked, pierced, formed, drawn, and embossed stampings of stainless steel, steel, brass, copper, aluminum and aluminum alloys, with press capacity to 70 tons.
(b) Internal and external thread protectors, stamped nuts, baffles, ferrules, etc.
(c) Assembling facilities.

Laminated Shim Co. Inc., Glennbrook, Conn.

(a) Flat and formed stampings, to approx 24 in. in diam. Press capacity from 7½ to 100 tons.
(b) To customers' specifications.
(c) Complete facilities.

Lansing Stamping Co., Lansing, Mich.

(a) Flat, drawn and formed stampings; of steel sheets, strip and plates; small to medium.
(b) To customers' specifications.
(c) Limited facilities.

Leake Stamping Co., The, 1250 East First St., Monroe, Mich.

(a) Deep drawn, formed and flat steel, aluminum and brass stampings; of all sizes requiring up to 400 ton pressure with 20 in. stroke.
(b) To customers' specifications.
(c) Welding, brazing and heat treating.

Lee Spring Co. Inc., 30 Main St., Brooklyn.

(a) Flat punched and formed stampings of spring steel, stainless, brass, copper, bronze, etc., from strip material only, up to 3 in. wide.
(b) Spring washers, spring clips, etc.
(c) Heat-treating and finishing facilities.

Lewyt Corp., 60 Broadway, Brooklyn 11, N. Y.

(a) Sheet metal stamping.
(b) Precision machine parts for electrical and electronic industries.
(c) Machining, finishing and assembling facilities.

Lidseen Inc., Gustave, 832-840 S. Central Ave., Chicago 44.

(a) Blanking, forming and drawing of steel, brass, stainless Monel and aluminum, up to 36 x 48 in., 500 tons.
(b) Radio speakers, brake pans, washing machine parts, etc.
(c) Machining, assembling, plating.

Lukens Steel Co., Coatesville, Pa.

(a) Hot-rolled plates up to 195 inches wide and from $\frac{3}{16}$ to 25 in. thick, spun and pressed steel heads and other pressed steel shapes in thicknesses from $\frac{3}{16}$-in. to 6 in.
(b) To customers' specifications.
(c) Complete facilities.

M

Macnick Co., 510 S. Lansing, Tulsa 5, Okla.

(a) Flat, drawn and formed (with combinations) stampings of all types of metals; 14 gage, limit on draws 2 in.; limit of size and thickness combination of 48 tons pressure.
(b) Clock, instrument and spring motor stampings.
(c) Complete facilities.

Market Forge Co., 59 Garvey St., Everett, Mass.

(a) All types of stampings in steel, aluminum and stainless; 48 x 30 in., max. draw 3 in.
(b) To customers' specifications.
(c) No information available.

Martin-Parry Corp., 1320 West Market St., York, Pa.

(a) Flat, shallow drawn, blank and formed stampings, of steel, brass and aluminum, 12 x 14 in. square.
(b) Small automotive and electrical household appliance stampings.
(c) Machining and assembling.

Master Products Co., The, 6400 Park Ave., S. E., Cleveland 5.

(a) Flat and formed miscellaneous small stampings, of nickel, hot and cold-rolled steel and other metals.
(b) To customers' specifications.
(c) Machining and heat-treating facilities.

Matthews Mfg. Co., 104 Gold St., Worcester 3, Mass.

(a) Flat, drawn and formed stampings of steel, brass, copper and aluminum; various sizes, depending on types.
(b) To customers' specifications.
(c) Complete facilities.

McCauley Metal Products Inc., 660 Grant St., Buffalo 13.

(a) All types of stampings (specializing in deep drawn), under 16 in. sq; of steel, brass, copper, aluminum, bronze, etc.
(b) To customers' specifications.
(c) Heat-treating and assembling facilities.

McDowell Mfg. Co., 301 Stanton Ave., Pittsburgh 9.

(a) All types of steel and brass stampings, ⅜ in. thick to 24 in. square.
(b) All types of machine parts.
(c) Machining and assembling.

Metal Auto Parts Co. Inc., 1428 W. Henry St., Indianapolis 7.

(a) Flat, drawn, deep-drawn and formed light gage stampings of steel and aluminum in medium and large sizes—downward from 16 in. deep and 48 x 96 in. in area.
(b) Automobile fenders, bodies, tops, radiator shells, miscellaneous refrigerator, range and household appliance stampings, etc.
(c) Welding and fabricating facilities.

Midland Steel Products Co., Cleveland 1 and Detroit.

(a) Flat, formed and drawn stampings of .05-.3 carbon and high-tensile steels in small, medium and heavy sizes to 25 ft long.
(b) Automotive.
(c) Machining and assembling facilities.

Milwaukee Metal Spinning Co., 422 West State St., Milwaukee 8.

(a) Parts produced by metal spinning from aluminum, brass, copper, steel, magnesium, zinc, stainless steel, Inconel, nickel, monel, nickel-silver, silver, gold, any metal and any alloy. From ⅛-in. to 8 ft diam, depth to 40 in. Aluminum or copper ¼-in. thick. Brass, hard alloys including stainless steel, monel inconel, $\frac{3}{16}$-in.
(b) For dairy and food handling equipment, farm machines, electric motors, unit heaters, air conditioning, aircraft, etc.
(c) Complete facilities.

Morrison Products Inc., 16816 Waterloo Rd., Cleveland.

(a) All gages up to ¼ in., deep drawn stampings to 6 in. deep, in steel and other metals.
(b) All types of machine parts.
(c) Complete assembling, spotwelding, riveting, machining and japanning facilities.

Mossberg Pressed Steel Corp., 81 West St., Attleboro, Mass.

(a) Flat, formed and shallow drawn stampings of steel; 36 in. diam max.
(b) Steel spools, reels, textile warp beams and braiding machine carriers.
(c) Machining, heat treating and welding facilities.

Motor Wheel Corp., 701 E. Saginaw St., Lansing 3, Mich.

(a) Flat, drawn and formed stampings, mostly of steel, some of aluminum and brass, in gages from ⅛ to ½ in., depth of draw approx 8 in. to 30 in. diam.
(b) Automotive, aircraft, implement, railroads and general industrial parts.
(c) Assembly, welding, machining.

Mullins Mfg. Corp., Salem, O. (Another plant at Warren, O.)

(a) Light and heavy-gage stampings, light-gage deep-drawn stampings from 20 to 16 gage in sizes to 80 x 160, depth of draw to 22 in.
(b) Washing machine tubs and automobile parts.
(c) Assembling facilities.

Murray Corp. of America, 7700 Russell St., Detroit 11.

(a) Light and heavy sheet metal stampings.
(b) Auto bodies, fenders, hoods, frames, grilles, cushion spring units, gas and electric ranges, washing machine parts, and airplane parts.
(c) Assembling, machining, heat-treating and finishing facilities.

N, O, P

Nagel-Chase Mfg. Co., 2811-23 N. Ashland Ave., Chicago.

(a) Flat, formed and small drawn stampings of sheet steel, up to 20 in. diam.
(b) V-belt sheaves (pulleys), washing machine casters, etc.
(c) Machining facilities.

New England Pressed Steel Co., Washington Ave., Natick, Mass.

(a) Stampings of steel, brass, copper, stainless steel and aluminum, small and medium.
(b) To customers' specifications.
(c) Heat-treating, finishing and assembling.

New Products Corp., Benton Harbor, Mich.

(a) Flat, drawn and formed stampings of steel; largest press capacity 140 tons.
(b) Commercial parts.
(c) Die room facilities.

Noera Mfg. Co., Div. of Chase Brass & Copper Co. Incorporated, Waterbury, Conn.

(a) Medium and light stampings of copper, brass, steel, 14 in. and smaller.
(b) Washers, oilers, etc.
(c) Assembling facilities.

Nordendale Mfg. Co., 2114 Carroll Ave., Chicago 12.

(a) Flat, drawn, formed, etc., in silicon steel, cold-rolled sheets, brass, aluminum, fiber, etc., up to 55 ton capacity.
(b) Laminations for radio and fluorescent transformers, also shells and housings for transformers.
(c) No information available.

Norris Stamping & Mfg. Co., 5215 S. Boyle Ave., Los Angeles 11.

(a) All types of sheet metal stampings and deep drawing; ferrous and nonferrous materials; sizes from very small to large.
(b) Subcontract stampings of all types.
(c) Complete facilities.

North & Judd Mfg. Co., New Britain, Conn.

(a) Flat, drawn and formed stampings of steel, brass, aluminum, nickel silver and copper; up to 15 sq in.
(b) Small metal parts.
(c) Case and oil hardening.

O. K. Stamping Corp., Fairfield and Poplar Aves., Fort Wayne, Ind.

(a) Stampings from smallest sizes to not exceeding 48 in. overall and not over 6 in. deep, of steel, brass, copper and aluminum.
(b) Laminations, cups, automatic phonograph and radio, liquid dispensing pump parts, etc.
(c) Complete facilities.

Parish Pressed Steel Co., Robeson & Weiser Sts., Reading, Pa.

(a) Soft steel, alloy and stainless steel, and aluminum flat, drawn and formed stampings in all sizes.
(b) Automotive, truck and bus frames, etc.
(c) Complete facilities.

Patton-MacGuyer Co., 17 Virginia Ave., Providence 5, R. I.

(a) Flat, drawn, formed and lettered stampings, in all metals. Area of blank not to exceed 16 sq in. Thickness, not greater than 1/16 in.
(b) Electrical and mechanical parts, particularly for electronic devices.
(c) Heat treating, power press work, thread rolling, tinning and small assembling.

Paul & Beekman Div., Portable Products Corp., 18th and Courtland Sts., Philadelphia 40.

(a) Flat, drawn, formed precision stampings and assemblies of aluminum, steel, copper, brass, etc.; press capacity to 180 tons.
(b) Drawn aluminum shells, coil shields, housings, sub-assemblies, component parts.
(c) Complete facilities.

Pawtucket Mfg. Co., P. O. Box 879, Pawtucket, R. I.

(a) Flat stampings of all kinds of materials; round, 6 in x ½ in. thick, and various other types and sizes.
(b) Various types of machine parts.
(c) Complete facilities.

Penn Metal Co. Inc., 205 E. 42nd St., New York 17.

(a) Expanded metal, steel plates, in all sizes up to 8 x 8 ft.
(b) Machine and window guards, open partitions, grills, air and oil filters, etc.
(c) Cold drawing.

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Powell Pressed Steel Co., Hubbard, O.

(a) All types of large or small stampings.
(b) Material handling equipment, automobile, refrigerator, washing machine parts, etc.
(c) Complete facilities.

Precise Metal Products Inc., 2990 Lakeside Ave., Cleveland.

(a) Flat and formed stampings of steel, brass, copper and aluminum. Presses of 150 tons.
(b) Miscellaneous machine parts.
(c) Heat treating and annealing.

Precision Metal Workers, 3100 Carroll Ave., Chicago 12.

(a) Flat, drawn and formed stampings of all types of metals; presses to 400 tons, bed area, 6-7 ft.
(b) To customers' specifications.
(c) Complete facilities.

Pressed Steel Tank Co., 1435 S. 66th St., Milwaukee 14.

(a) Cylindrical deep-drawn shells and shapes; of mild and alloy steel, nickel, aluminum, stainless, bronze, 4130, 8630, etc.; approx 5 to 29 in. OD, and 10 to 60 in. depth, 1/16 to ½-in. thick.
(b) Numerous types.
(c) Complete facilities.

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R

Raymond Mfg. Co., Div. Associated Spring Corp., Corry, Pa.

(a) Small stampings of steel, brass, phosphor bronze, Monel, etc.
(b) Springs (both coil and flat), wire shapes and forms, etc.
(c) Heat-treating facilities.

Reliable Spring Co., The, 3167 Fulton Rd., Cleveland.

(a) Blanking, forming, cutting of wire and strip in steel, stainless steel, brass, phosphor bronze, etc., flats to 3/16 in. thick x 4 in. diam and wire .006 in. to ⅜ in. diam.
(b) Springs, wire formations, bends, hooks, handles, clips, etc.
(c) Complete facilities.

Res Mfg. Co., 2915 W. Meinecke Ave., Milwaukee 10.

(a) Swedging, forming and drawing of steel and wire. Presses from 15 to 150 tons.
(b) Parts for automatic controls.
(c) Heat treating facilities.

Revere Products Corp., Phoenix, N. Y.

(a) Blanking, forming or drawing from light metals, steel, bronze, copper, stainless steel, aluminum, and brass, blanking to ¼ in. thick, forming to 36 in. long, drawing to 4 in. deep.
(b) Oil retainers, washers, escutcheons, etc.
(c) Complete facilities.

Richmond Brothers Co., 173-75 Chestnut St., Newark 5, N. J.

(a) Flat, formed and shallow drawn stampings in all metals; to 12 in. in size.
(b) To customers' specifications.
(c) Assembling facilities.

Rockford Metal Products Co., 716 Cedar St., Rockford, Ill.

(a) Drawing, forming, piercing of steel, stainless steel, aluminum, brass and zinc, approx 10 in. diam x 3½ in. cups; up to 16 in. diam or sq on shallow parts.
(b) Automotive and general stamping.
(c) Plating, riveting, welding, assembling and enameling.

Rockwood Sprinkler Co., 92 Harlow St., Worcester, Mass.

(a) Medium-heavy deep drawing and stamping of hot and cold-rolled steel; .063 to .375-in., ½ to 5 in. diam, 1 to 4 in. deep.
(b) Handles, pipe unions, pipe hangers.
(c) Sherardizing, Parkerizing facilities.

Rome-Turney Radiator Co., Rome, N. Y.

(a) Flat, drawn and formed stampings of steel, copper, brass and aluminum; 16 gage and 14 in. in diam, max size.
(b) Heat transfer equipment.
(c) Complete facilities.

Rosenbeck & Sons, J. H., Torrington, Conn.

(a) Flat, drawn and formed stampings in brass and steel, up to 2 in.
(b) Washers, shims, spacers, etc.
(c) No information available.

Ryerson & Haynes, Inc., 2307 E. Ganson St., Jackson, Mich.

(a) Flat, formed and drawn stampings of steel; in small and medium sizes.
(b) Automotive parts.
(c) Assembling facilities.

S, T

Santay Corp., 351 N. Crawford Ave., Chicago 24.

(a) Flat, drawn, formed, pierced, rolling and thread rolling; in carbon and stainless steel, aluminum, brass, copper, etc.; blank—steel and aluminum 1/16 in. thick—areas approx. 12 in. sq.
(b) Automotive accessories, exhaust, deflectors, tank caps, radio parts, housings, brackets, coverings, frames, and other mechanical and electromechanical parts.
(c) Machining and assembling facilities.

Scovill Mfg. Co., Waterbury, Conn.

(a) Brass, bronze, nickel silver, copper, aluminum, steel, and other metal stampings, drawn shells, formed parts and metal assemblies, nonferrous forgings.
(b) To customers' specifications.
(c) Complete facilities.

See advertisement Page 295

Spun Steel Corp., 1229 Camden Ave., S.W., Canton 6, O.

(a) Flat, drawn formed and roller-formed (Spunsteel process) stampings of steel in gage thickness to .200 in.; drawn cups, 14 in. in diam in 14-gage material.
(b) Roller formed and spun V-type pulleys to specification.
(c) Welding, heat treating and finishing. Also hydrogen welding and painting.

Standard Stamping Co. Inc., Nashville, Mich.

(a) Small and medium, flat and formed stampings of steel and brass.
(b) Spacers, bushings, spring clips, etc.
(c) Information not available.

Stanley Works, The., Pressed Metal Div., 195 Lake St., New Britain, Conn.

(a) Flat and formed stampings and deep drawn work.
(b) Hinges to customers' specifications.
(c) Complete finishing facilities.

Stolper Steel Products Corp., 3258 W. Fond du Lac Ave., Milwaukee.

(a) All types of fabricated sheet metal from ¼ in. steel and lighter.
(b) Gas tanks, fenders, hoods, housings, etc., to customers' specifications.
(c) Welding and assembling facilities.

Swanson Tool & Machine Products Inc., 810-14 E. Eighth St., Erie, Pa.

(a) Flat, drawn and formed stampings of all ferrous and nonferrous metals in medium and small sizes, up to 4 in. draw.
(b) To customers' specifications.
(c) Complete facilities.

Textile Shield Co., 1 Groton St., Lawrence, Mass.

(a) All kinds of flat, drawn and formed stampings of brass, steel, aluminum, nickel-silver, in any size up to .062 thick metal.
(b) Textile, automotive and electrical.
(c) None.

Titchener & Co., E. H., 136 Walnut St., Binghamton, N. Y.

(a) Flat and formed stampings in all metals; up to $\frac{5}{32}$ in. thick.
(b) Various.
(c) Finishing facilities.

Toledo Stamping & Mfg. Co., 99 Fearing Blvd., Toledo, O.

(a) Flat, drawn and formed hydrogen-furnace-brazed assemblies; of steel; in all sizes.
(b) Tractor frames, wheel guards, clutch housings, rocker arms, rocker shaft brackets, bomb fuses and adapters.
(c) Machining facilities.

Transue & Williams Steel Forging Corp., Alliance, O.

(a) Medium-sized stampings, blanked, formed, pierced and drawn, from hot and cold rolled steel, stainless steel, aluminum and Monel metal.
(b) All sizes and types of parts.
(c) Welding, brazing, punching and riveting.

Troxel Mfg. Co., The, Elyria, Ohio.

(a) Flat, drawn and formed stampings of rolled steel, stainless steel, monel, brass, phosphor-bronze and copper; from .005 to .125 thick.
(b) To customers' specifications.
(c) Heat-treating and assembling facilities.

Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland.

(a) Pressed steel stampings.
(b) From 20-gage on refrigerator stampings to heavier ones used for automotive parts.
(c) None.

U, V

Union Spring & Mfg. Co., New Kensington, Pa.

(a) Flat and formed stampings of steel, spring steel and bronze; ½ x $\frac{1}{32}$ in. metal up to 16 x ¼ in. for formed parts.
(b) Railway equipment, journal box lids, coil and elliptic springs, spring plates, etc.
(c) Complete facilities.

United-Carr Fastener Corp., 31 Ames St., Cambridge 42, Mass.

(a) Flat and drawn stampings of brass, cold-rolled steel, high-carbon steel, aluminum, monel, phosphor-bronze, etc.; in small sizes.
(b) Metal fasteners and fastening devices, etc.
(c) Assembling and machining facilities.

United Metal Spinning Co. Inc., 440 Adelphi St., Brooklyn 17.

(a) Flat and drawn stampings, of steel, brass, copper and aluminum; 6 x 5 x 5 in., and 16-in. circles.
(b) Fluorescent bodies, escutcheons, etc.
(c) Complete facilities.

Variety Machine & Stamping Co., The, 12695 Elmwood Ave., Cleveland.

(a) All types of stampings in brass, steel and aluminum, 36 in. diam and under.
(b) Miscellaneous machine parts.
(c) None.

W

Wagner, E. R., Mfg. Co., 4611 N. 32nd St., Milwaukee 9.

(a) Small and medium, flat, formed and drawn stampings of steel, brass, aluminum and stainless steel; also hinges and joint spacers.
(b) Washing machine and refrigerator parts to customer's specifications.
(c) Assembling, heat-treating, welding and finishing facilities.

Wagner Specialty Co., P. O. Box 404, Burlington, Wis.

(a) Blanked, formed and deep drawn stampings, of steel, brass, aluminum and stainless steel, max thickness .125, max size 12 x 12 in. and smaller.
(b) All types of machine parts.
(c) Complete facilities.

Wallace Barnes Co., Div. of Associated Spring Corp., Bristol, Conn.

(a) Flat and formed stampings of spring steel, stainless and alloys in small sizes.
(b) Various, to customers' specifications.
(c) Heat-treating facilities.

Western Cartridge Co., East Alton, Ill.

(a) Stamped and drawn; of brass, bronze, phosphor bronze, nickel silver, sheets, strips, coils.
(b) To customers' specifications.
(c) Information not available.

Western Washer & Stamping Co., 2111 E. 51st St., Los Angeles.

(a) Flat and formed stampings of steel, brass, copper, aluminum and alclad metals; various sizes.
(b) To customers' specifications.
(c) None.

Whitehead Stamping Co., 1691-3 W. Lafayette Blvd., Detroit 16.

(a) Light and medium stampings.
(b) SAE standard, U. S. standard, steel and brass washers.
(c) Complete facilities.

Williams, H. E., Products Co., 100-122 S. Main St., Carthage, Mo.

(a) Light stampings, sheet metal fabrication, steel and nonferrous metals, press size to 150 tons capacity.
(b) Automotive, electrical fluorescent light fixtures, etc.
(c) Turret lathes, screw machines, spot welders, plating, ovens for baking finishes.

Williams-Wallace Co., 160 Hooper St., San Francisco 7.

(a) Flat, formed, rolled, stamped, punched, 14 to 30 gage; of steel, copper, brass, aluminum.
(b) Fittings and other miscellaneous parts.
(c) Welding and finishing facilities.

Winzeler Mfg. & Tool Co., 1712 W. Arcade Place, Chicago 12.

(a) Blanking, drawing and forming, of aluminum, bakelite, brass, steel, magnesium, etc. Presses to 5 in. stroke and 90 ton capacities.
(b) Gears, small mechanical parts, laminations for electrical units, etc.
(c) No information available.

Woodworth Specialties Co., 239 Water St., Binghamton, N. Y.

(a) Flat, shallow drawn, formed and punched stampings of steel, copper, brass, nickel, monel, stainless steel, nickel silver, aluminum, etc., in sizes requiring presses to 40 tons capacity.
(b) Electric terminals, shallow cups and collars, disks, rings, ferrules, etc.
(c) Assembling and wire forming.

Worcester Pressed Steel Co., 111 Barber Ave., Worcester, Mass.

(a) Pressed metal stampings of any metal or alloy from ½ in. to 4 ft diam, in lengths to 7 ft, drawn to a depth of 21 in.; using material from .002 to ½ in. thick; cold forgings at 1500 tons pressure.
(b) Automotive, airplane, oil burner, office equipment, transmission parts, etc.
(c) Complete facilities.

See advertisement Page 291

Worcester Stamped Metal Co. Inc., 9 Hunt St., Worcester, Mass.

(a) Light and heavy stampings of steel, brass, aluminum, copper and stainless steel, large and small.
(b) To customers' specifications.
(c) Annealing and hardening facilities.

Wrought Washer Mfg. Co., 2102 S. Bay St., Milwaukee.

(a) Stampings, blanking, forming, drawing, extruding, in all ferrous and nonferrous metals. Presses 300 tons capacity; material up to 1¼ in. thick.
(b) Washers, expansion plugs, automotive, etc.
(c) Complete facilities.

Forgings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of forgings; (b) Names of forged machine parts customarily produced; and (c) Machining or heat-treating facilities

A

Accurate Brass Co., Inc., 73rd Ave. and 88th St., Glendale, Brooklyn 27.

(a) Press forgings of brass to 10 lb, copper to 4 lb, and aluminum to 2 lb.
(b) Parts for all types of machines.
(c) Machine facilities for brass forgings; aluminum forgings, heat treated.

Aircraft Mechanics Inc., Colorado Springs, Colo.

(a) Alloy and carbon steel closed-die forgings, up to 15 lb.
(b) Aircraft, automotive, precision parts, as well as parts to customers' specifications.
(c) Machine shop and heat treating facilities.

Allegheny Ludlum Steel Corp. (plants in Brackenridge and West Leechburg, Pa.; Buffalo, Dunkirk and Watervliet, N. Y.; Detroit; Los Angeles; Marengo, Ill.; and Wallingford, Conn.)

(a) Hammer and die forgings of stainless and heat-resisting steels, electrical steels and alloys, and nitriding steels.
(b) Disks, rings, blocks, special shapes, shafts, hubs, bars, etc.
(c) Annealing, heat treating and machining.

See advertisement, Page 313

Alliance Drop Forging Co., P. O. Box 427, Alliance, O.

(a) Small closed-die drop forgings.
(b) To customers' specifications.
(c) Treated and shot blasted, not machined.

Allis-Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee 1.

(a) All type steel hammered, drop and pressed forgings; 40 in. in diam, 60 ft long and 40 tons in weight.
(b) Turbine, generator and propulsion shafts, engine parts, etc.
(c) Complete facilities.

Aluminum Company of America, Gulf Bldg., Pittsburgh.

(a) Aluminum and magnesium; any sizes.
(b) Largely aircraft and aircraft engine parts.
(c) Heat-treating facilities.

See advertisements, Pages 267, 271 and 287

American Brass Co., Waterbury, Conn.

(a) Hot-pressed copper, brass, bronze, nickel silver, and special copper alloys in small sizes and shapes.
(b) To customers' specifications.
(c) None.

See advertisements, Pages 297-298

American Car & Foundry Co., 30 Church St., New York 8.

(a) Steel hammered, drop and pressed forgings, approx 5 lb each and up.
(b) Railway cars and miscellaneous machine parts.
(c) Complete facilities.

American Chain & Cable Co. Inc., Bridgeport, Conn. (plant at Braddock, Pa.)

(a) Carbon and alloy steel drop, hammer and upset forgings, up to 40 lb, 20 x 6 in.
(b) Chain and cable hooks, shackles and special forged machine parts.
(c) Heat treating only.

American Forge Div., American Brake Shoe Co., 332 S. Michigan Ave., Chicago.

(a) Alloy and carbon steel closed-die and upset forgings.
(b) To customers' specifications.
(c) Complete heat-treating facilities.

American Forge Co., 735 Ashley Ave., Berkeley, Calif.

(a) Hammered and pressed forgings; carbon and alloy, to 75,000 lb max; drop forgings to 15 lb max in steel, carbon steel and stainless.
(b) Diesel engine and other machine parts.
(c) Normalizing and annealing.

American Hollow Boring Co., Erie, Pa.

a) Hollow-bored forgings.
(b) Spindles, hydraulic cylinders, piston rods, clutch shafts, etc.
(c) Information not available.

American Magnesium Corp., 2210 Harvard Ave., Cleveland.

(a) Hammer and pressed forgings, of magnesium alloys, in any size.
(b) To customers' specifications.
(c) No information available.

See advertisement, Page 145

Ampco Metal Inc., 1745 S. 38th St., Milwaukee.

(a) All practical sizes, in all copper base alloys.
(b) Aircraft parts and engines, machine tool, heavy machinery and chemical equipment.
(c) Complete facilities.

See advertisement, Page 288

Atlas Drop Forge Co., 209 W. Mount Hope Ave., Lansing 2, Mich.

(a) Steel closed-die forgings from ¼ lb to 250 lb.
(b) Farm implement, tractor, railroad, aviation, automotive, etc.
(c) Heat-treating facilities for rough forgings.

Atwater Mfg. Co., Plantsville, Conn.

(a) Steel closed-die and upset forgings to 20 lb.
(b) To customers' specifications.
(c) Heat treating.

B

Baldt Anchor, Chain & Forge Div., The Boston Metals Co., Sixth and Butler Sts., Chester, Pa.

(a) Flat die drop forgings of steel of any type, from ½ to 300 lb. Drop forging hammers from 800 to 8000 lb; upsetting machines from 2½ to 6 in.
(b) Marine anchors and chains.
(c) Complete facilities.

Barium Steel & Forge, Inc., 1502 Allen St., S. E., Canton 1.

(a) Hammer and press forgings, 10 lb to to 50,000 lb; carbon, alloy and all tool grade steels.
(b) Rings, shafting, bars, die blocks, hammer rams, piston rods and other parts to customers' specifications.
(c) Complete heat treating and rough finishing facilities.

Bay City Forge Co., 1802 Cranberry St., Erie, Pa.

(a) Hammered steel forgings, 50 to 5000 lb each.
(b) Crankshafts, connecting rods, shafting, rolls, etc.
(c) Annealing, normalizing, quenched and drawn.

Bethlehem Steel Co., Bethlehem, Pa.

(a) Open die forgings to 225,000 lb in all grades of carbon and alloy steels—solid and hollow. Drop forgings from 1 to 350 lb. Also upset forgings.
(b) Shafts, rotors, rolls, gears and other press and hammer forgings.
(c) Complete facilities.

See advertisement, Page 274

Billings & Spencer Co., The, 1 Laurel St., Hartford 6, Conn.

(a) Closed-die forgings in brass, bronze, stainless steel, alloys, straight carbon steel, Monel metal and tool steel; to 100 lb.
(b) Airplane, automobile, machine tool, gas and diesel engine, conveyor, mining machinery, typewriter parts, etc.
(c) Complete facilities.

See advertisement, Page 292

Blakeslee Forging Co., 86 W. Main St., Plantsville, Conn.

(a) All grades of steel closed-die forgings, up to 20 lb.
(b) Automotive and machine parts.
(c) Annealing.

Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit, Mich.

(a) Hot-pressed brass and aluminum forgings to 15 lb in brass and to 10 lb in aluminum, depending upon the design.
(b) To customers' specifications.
(c) Heat-treating facilities.

See advertisement, Page 163

Bonney Forge & Tool Works, Allentown, Pa.

(a) Closed-die drop forgings up to 8 lb; of any grade steel, alloy or carbon; also small upset forgings.

(b) To customers' specifications.

(c) Complete facilities.

Brewer-Titchener Corp., 111 Port Watson St., Cortland, N. Y.

(a) Ferrous, closed-die and upset forgings up to 28 lb.

(b) Automotive, aircraft transmission and custom drop forgings.

(c) Complete facilities.

Buckeye Forging Co., 10001 Harvard Ave., Cleveland 5.

(a) Small closed-die forgings of carbon and alloy steels, stainless steels, brass and copper.

(b) Automotive, tractor, tank, etc.

(c) Machining facilities.

Burke Steel Co., Inc., 30 Sherer St., Rochester 2, N. Y.

(a) Open hammer flat die forgings of all steels. Disks and rings, ½ x 4 in. to 12 x 30 in. Blocks, 5 to 1200 lb or up to 20 x 20 x 10 in. Bars in rounds, squares, hexagon or octagon; 1½ to 12 in. Flats, 1 to 12 in. in width or thickness. Length, up to 12 ft annealed and 14 ft unannealed.

(b) Disks, rings, blocks, hubs, etc.

(c) Complete heat-treating facilities.

C

Cann & Saul Steel Co., 516 Commerce St., Philadelphia 6.

(a) Hammered and pressed, smooth forged or rough turned, steel (carbon. alloy and stainless) forgings of shafts or bars 18 in. in diam max (17 000 lb), rings 42 in. OD max, disks or hubs 33 OD max (2000 lb).

(b) Shafts. bars, spindles, gear blanks, rings, ball races, etc.

(c) Heat-treating facilities.

Canton Drop Forging & Mfg. Co., Canton, O.

(a) Closed-die, drop hammered, upset, rolled, pressed and extruded forgings, in ferrous and nonferrous metals, up to 1 ton.

(b) Heavy and light parts for cars, trucks, aircraft. railroad equipment and industrial machinery.

(c) Machining and heat treating.

Carnegie-Illinois Steel Corp., 434 Fifth Ave., Pittsburgh.

(a) All type forgings produced with open dies, in all types of steel. Round—body diameter 68 in., max collar dia 90 in., max weight 220,000 lb. Rectangular—to 30 in. max thickness, 150 in. max width, with max weight of 220,000 lb. Hollow rounds—max OD 140 in.

(b) Axles. bars, bridge pins. hexagon shafts, propeller shafts, rotors, locomotive parts, back-up rolls. sleeves. pinions, reduction gears, mill housings, etc.

(c) Complete facilities.

See advertisement, Page 157

Carpenter Steel Co., The, 120 Bern St., Reading, Pa.

(a) Simple forgings made on flat dies in all SAE, stainless and tool steels to 3000 lb.

(b) Rings, disks, blocks, simple shafts, axles, etc.

(c) All heat-treating facilities; minimum of machine work.

See advertisements Pages 154-155 and 286

Champion Machine & Forging Co., 3695 E. 78 St., Cleveland.

(a) Closed-die steel drop forgings to 3000 lb.

(b) To customers' specifications.

(c) Heat-treating facilities.

Chase Brass & Copper Co., Inc., 236 Grand St., Waterbury 91, Conn.

(a) Brass, naval brass. copper and copper alloy, and Olympic silicon bronze.

(b) Automotive, aircraft, refrigeration parts, air valves, etc.

(c) Annealing, machining, polishing and plating facilities.

Clapp, E. D., Mfg. Co., 305 Genesee St., Auburn, N. Y.

(a) Closed-die drop forgings of carbon, alloy, tool. stainless steel, Monel, brass, bronze, copper, etc.

(b) Aircraft, automotive, railroad, tractor, etc.

(c) Complete facilities.

Cleveland City Forge Co., 4501 Lakeside Ave., Cleveland.

(a) Closed-die and upset forgings of carbon and alloy steel from few ounces to several hundred pounds.

(b) To customers' specifications.

(c) Complete facilities.

Cleveland Hardware & Forging Co., 3270 E. 79th St., Cleveland.

(a) Closed-die and upset forgings in steel and brass.

(b) To customers' specifications.

(c) Complete facilities.

Clifford-Jacobs Forging Co., Box 330, Champaign, Ill.

(a) Carbon and alloy steel closed-die drop forgings, to 1500 lb.

(b) Railway car, automotive, tractor and general industrial drop forgings.

(c) Annealing, normalizing and hardening.

Columbus Anvil & Forging Co., The, 115 W. Frankfort St., Columbus 16, O.

(a) Hammered forgings of carbon and alloy steel. Ring 36 in. in diam; shafts 12 in. in diam; gear blanks up to approx 350 lb.

(b) King pins for road rollers, gear blanks for machines crankshafts etc.

(c) Heat-treating facilities.

Columbus Bolt Works Co., 291 Marconi Blvd., Columbus 16, O.

(a) Closed-die drop steel forgings, to 5 lb.

(b) To customers' specifications.

(c) Machining, heat-treating, plating.

Columbus Forge & Iron Co., The, 544 W. First Ave., Columbus, O.

(a) Steel alloy and plain carbon drop forgings; from ½ to 150 lb.

(b) Parts for automobiles, trucks, road mining machinery, aircraft, machine tools. etc.

(c) Semifinishing, normalizing and annealing.

Cornell Forge Co., 6666 W. 66th St., Chicago 38.

(a) Closed-die drop forgings, from fraction of ounce to 15 lb in carbon, alloy and stainless steel and monel metal.

(b) Cams pins crankshafts, connecting rods, gears, clutch hubs, links, etc.

(c) Annealing and shot blasting.

Crucible Steel Co. of America, 405 Lexington Ave., New York.

(a) All types of forgings in carbon and alloy grades, to 40 tons max weight.

(b) Crankshafts, propeller shafts. piston rods, rams, gun forgings, rings, disks, etc.

(c) Complete facilities.

D

Davenport Besler Corp., 2305 Rockingham Rd., Davenport, Ia.

(a) Closed-die drop forgings and open steam hammer forgings.

(b) Crankshafts. connecting rods, levers, automotive and railway equipment.

(c) Complete facilities.

Dayton Forging & Heat Treating Co., The, 2323 E. First St., Dayton, O.

(a) Flat die forgings, smooth forged or rough machined, made of SAE steels, NAE steels, straight carbon steels in all sizes to 30 in. diam and 16 ft long on bars of 12 in. diam; and 6 ft long on bars of 16 in. diam.

(b) Collets, bars. shafts, gear blanks, rings, bushings. spindles, sleeves, studs, arbors, collars, etc.

(c) Machining, heat treating, shot blasting.

Delaware Alloy Forge Co., 2300 E. Tioga St., Philadelphia.

(a) Flat die steam hammer work in stainless steel. tool steel. Nitralloy, Monel metal, bronze and other alloys from 1 to 5000 lb.

(b) Seat rings for large valves, knitting machine cylinders, paper machinery shafts, and gears.

(c) Complete facilities.

Dow Chemical Co., The, Midland, Mich.

(a) Magnesium alloy forgings.

(b) To customers' specifications.

(c) Heat-treating facilities.

Dresser Mfg. Div., Dresser Industries Inc., Bradford, Pa.

a) Upset and closed-die hydraulic pressed steel forgings to 25 lb.

(b) Cone bushings, aircraft parts, bearing retainer rings, pipe coupling rings. welding ells, friction snubber sleeves, truck and trailer wheels. air-dump cylinders, etc.

(c) Machining facilities.

See advertisement, Page 146

Drop Dies & Forgings Co., 3097 E. 61st St., Cleveland.

(a) Drop forgings up to 25 lb.

(b) To customers' specifications.

(c) Heat-treating facilities.

Duff-Norton Mfg. Co., 2709 Preble Ave., N. S., Pittsburgh 30.

(a) Flat and closed-die forgings of carbons, alloy and stainless steel. bronze and brass; from .10 to 80 lb; diam not exceeding 9 in.

(b) To customers' specifications.

(c) Normalizing, annealing, heat treating.

Dyson, Joseph, & Sons, Inc., 5125 St. Clair Ave., Cleveland 14.

(a) Steel and aluminum hammered and hydraulic pressed forgings in 2 to 5000 lb.

(b) Shafts, die blocks, spindles, weldless rings, gear blanks. bars, nuts, etc.

(c) Complete facilities.

E

Ellwood City Forge Co., Box 590, Ellwood City, Pa.

(a) Steel forgings, 25 to 35,000 lb.

(b) Crankshafts for aircraft, automobile, gas steam, or diesel engines.

(c) Complete facilities.

Endicott Forging & Mfg. Co. Inc., Endicott, N. Y.

(a) Closed-die drop and upset forgings, of carbon and alloy steels, Monel, stainless, Nitralloy, brass, copper and bronze, from 2 oz to 80 lb.

(b) Gear blanks, crankshafts, connecting rods, rocker arms, etc.
(c) Heat-treating facilities.

Erie Forge Co., Erie, Pa.

(a) Flat die, press and hammered steel forgings.
(b) Marine, stationary engine crankshafts, etc.
(c) Complete facilities.

F

Falleen Drop Forge Co., Filer City, Manistee Co., Mich.

(a) Steam hammer closed-die and upset forgings in carbon and alloy steels, ½ to 45 lb.
(b) To customers' specifications.
(c) Heat-treating facilities.

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14.

(a) Hammer and press forgings in carbon and alloy steels from 5 to 50,000 lb each.
(b) Shafts, rolls, rings, gear blanks, etc.
(c) Complete facilities.

Forging and Casting Div., Allegheny Ludlum Corp., Ferndale, Mich.

(a) Smooth hammered forgings, of SAE, NE steels, stainless and Nitralloy; ½ to 1500 lb.
(b) Rings, blocks, disks, and irregular shaped forgings.
(c) Annealing and rough machining.

Forgings & Stampings Inc., 23rd Ave. and Seventh St., Rockford, Ill.

(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

G

Gardiner Mfg. Co., 2711 Union St., Oakland 7, Calif.

(a) Closed-die drop forgings to 52 lb; also hammer and upset forgings to 5 in. round or square.
(b) Gearshift levers, bolts, etc.
(c) Machining and fabrication facilities.

General Drop Forge Div., Brown-Lipe Gear Co., 1738 Elmwood Ave., Buffalo 7.

(a) Closed-die drop-forged and upset forgings, of carbon, stainless, Monel and other alloys, 1 oz to 100 lb.
(b) Rings, gears, stem pinions, side gears, connecting rods, etc.
(c) Heat-treating and machining.

General Metals Corp., Liberty & Homestead Rds., P. O. Box 198, Houston 1, Texas.

(a) Closed-die drop and open frame hammered forgings of all types of steel, brass and bronze in small to medium sizes, 1200 to 5000 lb hammer range.
(b) Valve parts, unions, bit blades, etc., for refinery equipment.
(c) Complete facilities.

Giant Grip Mfg. Co., Oshkosh, Wis.

(a) Closed-die drop forgings from a fraction of an ounce to 4 lb; in carbon range of SAE 1015 to SAE 1045.
(b) To customers' specification.
(c) No information available.

Globe Forge Inc., Peat St., Syracuse, N. Y.

(a) Closed-die drop and upset forgings in carbon and alloys from few ounces to 125 lb.
(b) Differential, transmission gears.
(c) Complete facilities.

Green Bay Drop Forge Co., 1341 S. State St., Green Bay, Wis.

(a) Drop forgings of steel; 10 lb max size.
(b) Aircraft and automotive parts.
(c) Complete facilities.

H

Hammond & Irving Inc., 254 North St., Auburn, N. Y.

(a) Steam hammer forgings in alloy and tool steels, stainless, Nitralloy and Monel metals, to 1200 lb.
(b) Weldless rings, gear blanks, shafts, hammered bars, etc.
(c) Complete facilities.

Harrisburg Steel Corp., 10th and Herr Sts., Harrisburg, Pa.

(a) Alloy and carbon open-hearth steel closed-die drop forgings which can be produced on steam drop hammers from 1000 to 8000 lb.
(b) All types of machine parts.
(c) Complete facilities.

Harris-Thomas Drop Forge Co., 126 Harshman St., Dayton, O.

(a) Closed-die drop forgings.
(b) To customers' specifications.
(c) Information not available.

Harvey Mfg. Co., 17th & Murray Sts., Racine, Wis.

(a) Carbon and alloys steel closed-die drop hammered forgings, ¼ to 40 lb.
(b) Agricultural machinery parts.
(c) Annealing furnaces.

Harvey Metal Corp., 74th and Ashland Ave., Chicago 36.

(a) Hammered, drop and hot pressed forgings, in aluminum, brass, bronze, copper bearing alloys. Brass and bronze, max 40 lb; aluminum, 12-15 lb max.
(b) To customers' specifications.
(c) Machining and aluminum heat treating

Henry & Allen Inc., 2-36 Wadsworth St., Auburn, N. Y.

(a) Drop and hammered forgings of carbon and alloy steel, under 1 lb to 12 lb.
(b) Agricultural, automobile and commercial.
(c) Complete heat-treating facilities.

Heppenstall Co., (Plants at 4622 Hatfield St., Pittsburgh 1, and 95 Howard Ave., Bridgeport 5, Conn.)

(a) Forgings of carbon and alloy steels, to 45,000 lb rough turned weight.
(b) Shafts, crankshafts, die blocks, shear knives, rolls, etc.
(c) Complete facilities.

Herbrand Corp., The, Fremont, O.

(a) Closed-die drop forgings of all types of steel.
(b) Automobile, aircraft, truck, etc.
(c) Heat-treating facilities.

I

Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7.

(a) Pressed forgings in aluminum (1½ x 3 in.), and brass (1¾ x 4 in.).
(b) Aircraft, automotive, industrial and refrigeration parts; tube fittings and shutoff valves.
(c) Complete facilities.

Indianapolis Drop Forging Co., 1300 Madison Ave., Indianapolis 7.

(a) Hammered and closed-die drop forgings in steel, copper and brass; hammered, up to 200 lb; drop up to 50 lb.
(b) To customers' specifications.
(c) Heat-treating facilities.

Indiana Forge & Machine Co., Indiana Harbor Station, East Chicago.

(a) Closed-die steel drop forgings to 4 lb.
(b) Clutch hubs.
(c) Annealing only; no machining.

International Nickel Co., Inc., The, 67 Wall St., New York 5.

(a) Hammered forgings of nickel, Monel, Inconel, "K" Monel and "Z" nickel.
(b) To customers' specifications.
(c) Complete facilities.

See advertisement, Page 143

Interstate Drop Forge Co., 4049 N. 27th St., Milwaukee.

(a) Closed-die drop and upset forgings of carbon and stainless steel.
(b) Forged parts to customers' designs, crankshafts, connecting rods, gears, levers, etc.
(c) Machining, heat treating and inspection

Isaacson Iron Works, 2917 E. Marginal Way, Box 3028, Seattle 14.

(a) Hammered, pressed and upset forgings, of mild and alloy steels, from 5 to 65,000 lb.
(b) Gearing, ship shafting and road building equipment.
(c) Salt bath heating, machining

J

Jersey Forging Works, 803 Jersey Ave., Jersey City, N. J.

(a) Alloy steel and standard SAE steel forgings.
(b) Gear blanks, rings, sleeves, rolls, shafts, spindles, etc.
(c) Complete facilities.

Johnson Forge & Machinery Co., Inc., A. Mishawaka, Ind.

(a) Drop, hammered and upset forgings of carbon, alloy and stainless steel; 1½ to 40 lb. in size.
(b) Axle shafts, pinion gears, etc.
(c) Complete facilities.

Johnston & Jennings Co., 877 Addison Rd., Cleveland 14.

(a) Flat die forgings in plain carbon and alloy steels, 1 lb to 5 tons.
(b) Spindles, solid and hollow-bored; rings arbors, shafts, gears, etc.
(c) Complete machine shop facilities

K

Kelly Steel Works Inc., 5757 W. 65th St., Chicago 38.

(a) Upset and drop forgings, of steel. Upset 1½ to 6 in.; drop hammers, 2000 to 3000 lb.
(b) Truck, tractor, automotive, locomotive, and machinery parts.
(c) No information available.

Keystone Forging Co., Northumberland, Pa.

(a) Closed-die drop forgings of steel, brass and other alloys not exceeding 3 lb.
(b) To customers' specifications.
(c) Complete facilities.

Koppers Co., Inc., Bartlett Hayward Div., 200 Scott St., Baltimore 3, Md.

(a) D-H-S bronze and steel-hammered forgings up to 40 carbon in 2 to 8 in. rounds.
(b) To customers' specifications.
(c) Complete facilities.

Kortick Mfg. Co., 345 First St., San Francisco.

(a) Closed-die drop, press and upset forgings.
(b) Airplane, engine, tractor, and other miscellaneous or special parts.
(c) None.

Kraeuter & Co. Inc., 585 Eighteenth Ave., Newark 3, N. J. (Drop Forging Div., Nye Ave. and S. Twentieth St., Irvington 11, N. J.)

(a) Closed-die and upset forgings, of Monel, bronze and carbon, stainless and alloy steels, ½ oz to 20 lb.
(b) To customers' specifications.
(c) Limited facilities.

Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.

(a) Steam hammer to 20 tons; drop and upset; ferrous and nonferrous.
(b) To customers' specifications; merchant bars, die blocks, flanges.
(c) Machining, heat treating, Magnaflux inspection.

See advertisement, Page 296

L

Ladish Drop Forge Co., Cudahy, Wis.

(a) Closed-die drop up to 3200 lb, hammered and upset forgings of carbon and alloy steel.
(b) Crankshafts, camshafts, connecting rods, forged and seamless welding fittings, weldless rolled rings, etc.
(c) Machining and heat treating.

Lakeview Forge Co., Pittsburgh Ave., Erie, Pa.

(a) Closed-die drop forgings to 10 lb in alloy or carbon steel.
(b) To customers' specifications.
(c) None.

Lamson & Sessions Co., The, Cleveland, Kent, Chicago and Birmingham, Ala.

(a) Small hot and cold upset forgings of any metal or alloy.
(b) Bolts, nuts, cotters, capscrews and special hot and cold upset products.
(c) Complete facilities.

Lansing Drop Forge Co., Logan and Albert Sts., Lansing, Mich.

(a) Closed-die drop forgings to 40 lb coined, machined and heat-treated forgings, of all grades of carbon steel, Monel metal, aluminum and other alloys, from 2 oz to about 40 lb.
(b) Steering arms, shift levers, small crankshafts, camshafts, shock absorber arms, rocker arms, gears, housings, aircraft and ordnance parts, etc.
(c) Complete facilities.

Larson, Charles E., & Sons Inc., 2645-2665 N. Keeler Ave., Chicago 39.

(a) Large and small hammered forgings in iron and steel, high-carbon, high-chrome, high-speed, Monel and copper and other alloys.
(b) Miscellaneous parts.
(c) Complete facilities.

Latrobe Electric Steel Co., Latrobe, Pa.

(a) High-speed, carbon and alloy tool steel forgings, blocks and disks approx. 16 in. cube; flats approx. 20 x 10 in.
(b) Shear blades, disks, hobs, gear shaper forgings, cutter blanks, etc.
(c) Heat-treating facilities.

Laughlin, Thos., Co., The, 143 Fore St., Portland, Me.

(a) Closed-die drop forgings of rounds and flats steel, from 2 oz to 50 lb.
(b) Marine and industrial, wire rope and chain accessories.
(c) Machining, heat treating and galvanizing facilities.

Leard, William, Co. Inc., New Brighton, Pa.

(a) Hammered and hydraulic pressed steel forgings to 45,000 lb.
(b) Crankshafts, connecting rods and other type forged steel shafts.
(c) Complete facilities.

Letts Drop Forge Inc., 2714 W. Jefferson Ave., Detroit.

(a) Small and medium closed-die drop forgings in carbon and alloy bar stock.
(b) Automotive, aircraft, ordnance and maritime.
(c) Heat treating.

Lindell Drop Forge Co., S. Logan and N. Y. C. R. R., Lansing, Mich.

(a) Carbon and alloy steel closed-die forgings, from 1 oz to 30 lb.
(b) For automotive, agricultural, mining machinery, etc.
(c) None.

M

Machinery Forging Co., The, 5450 Hamilton Ave., Cleveland.

(a) Flat die forgings of carbon and alloy steels, 1-2000 lb.
(b) Rings, disks, blocks, spindles, bars, hubs, etc.
(c) Rough turning only.

Manganese Steel Forge Co., Richmond St. & Castor Ave., Philadelphia.

(a) Upset and pressed forgings in 11-14 per cent manganese steel to 50 lb.
(b) Headed pins.
(c) Complete facilities.

McKaig-Hatch Inc., 125 Skillen St., Buffalo 7.

(a) Drop and upset forgings in carbon, alloy, stainless steel, aluminum, bronze, brass, copper, nickel and magnesium; 3 oz to 15 lb depending upon the shape.
(b) Automotive and other parts to customers' specifications.
(c) Complete facilities.

Melling Forging Co., 1401 Case St., Lansing, Mich.

(a) Steel closed-die drop forgings; from 1 oz to 8 lb.
(b) To customers' specifications.
(c) Complete facilities.

Merrill Brothers, 56 Arnold Ave., Maspeth, Queens, N. Y.

(a) Drop forgings of steel and alloys, from fraction of oz to 100 lb or more.
(b) Turnbuckles, clevis nuts, shackles, eyebolts, hexagon sleeve nuts, clamps, etc.
(c) Information not available.

Mesta Machine Co., Box 1466, Pittsburgh.

(a) Very large steel and alloy steel forgings, both hollow and solid.
(b) Shafts, pinions, rolls, high pressure cylinders and reaction vessels.
(c) Complete facilities.

Michigan Forging Co., 4000 W. Jefferson, Detroit 9.

(a) Drop forgings of steel from 1 to 10 lb in size.
(b) Miscellaneous machine parts.
(c) None.

Midvale Co., The, Nicetown, Philadelphia.

(a) Press and hammer forgings, solid or hollow, in carbon, alloy and stainless steels.
(b) Rings for mining and cement machinery, flanges, gear bands, heavy shafting, turbine shafts, turbine bucket wheels, gas turbine wheels, crankshafts for large steam and internal combustion engines; weldless high pressure vessels, stainless steel forgings and billets. Hardened and ground rolls.
(c) Complete facilities.

Milwaukee Forge & Machine Co., 1532 E. Oklahoma Ave., Milwaukee 7, Wis.

(a) Open-frame and drop-hammered closed-die forgings and weldless rolled steel rings in carbon and alloy steel, any size.
(b) Crankshafts, hub forgings, axles and weldless (seamless) rolled rings.
(c) Complete facilities.

Mitchell Steel Co., The, Stockyards Station, Cincinnati.

(a) Steam hammer forgings in plain carbon alloy and stainless steel.
(b) All types of machine parts, railroad, marine, etc.
(c) Complete facilities.

Moline Forge Inc., 4101 Fourth Ave., Moline, Ill.

(a) Closed-die dropped and pressed forgings of heat-resistant steel, carbon and alloys, within capacity of 2500 and 3000 lb board drop hammer; pressed forgings for presses to 300 tons.
(b) For oil field, small diesel engine, automotive, agricultural equipment parts, etc.
(c) Hardening and drawing furnaces.

Mondie Forge Co. Inc., 10300 Berea Rd., Cleveland.

(a) Closed-die drop forgings to 75 lb, upset forgings to 4 in., also coining.
(b) Gear blanks and other parts to customers' specifications.
(c) Information not available.

Moore Drop Forging Co., 36 Walter St., Springfield, Mass.

(a) Closed-die drop, upset and coined forgings.
(b) To customers' specifications.
(c) Heat treating and machining

Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.

(a) Drop hammered and pressed forgings of brass, bronze, copper, aluminum and alloys; 1 oz to 25 lb.
(b) Valves, fittings and other accessories.
(c) Screw machining, finishing, heat treating.

N,O

National Forge & Ordnance Co., Irvine, Warren County, Pa.

(a) Hammered and pressed steel forgings.
(b) Rough and finished machined parts.
(c) Complete machining facilities.

National Lock Washer Co., 40 Hermon St., Newark 5, N. J.

(a) Small closed-die drop forgings.
(b) Steel rod ends in adjustable yoke, plain yoke and eye types; steel clevis pins for steel rod ends; steel plugs, rings and flanges; all in standard sizes. Also various custom forgings to order.
(c) Heat treating and machining.

Octigan Forge & Mfg. Co., 2428 S. Lowe Ave., Chicago 16.

(a) Closed-die drop forgings.

(b) To customers' specifications.
(c) None.

Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland 4.

(a) Closed-die drop, upset and flat hammer steel forgings in all sizes.
(b) All types of precision gears, spline shafts, power transmitting equipment.
(c) Complete heat-treating. Machining for gears and shafts only.

Oliver Iron & Steel Corp., N. E. Corner S. 10th and Muriel Sts., Pittsburgh.

(a) Small drop and upset forgings, rough or machined, in carbon or alloy steels, in sizes to 8 in. in diam, and 15 lb in wt.
(b) Bolts, nuts, screws, rivets and either hot or cold-headed special parts.
(c) Complete facilities.

Owensboro Forging Co., Owensboro, Ky.

(a) Small closed-die drop forgings.
(b) To customers' specifications.
(c) Limited.

P

Pacific Car & Foundry Co., Renton, Washington.

(a) Hammered, drop and upset forgings of steel; to 8 in.
(b) Gears, pistons, connecting links, etc.
(c) Complete facilities.

Park Drop Forge Co., The, 777 E. 79th St., Cleveland.

(a) All types of closed-die drop steel forgings to 4000 lb.
(b) Crankshafts, connecting rods, camshafts, axles, gears, etc.
(c) No information available.

Phoenix Mfg. Co., Front & Chapel Sts., Catasaqua, Pa.

(a) Drop forgings to 40 in.
(b) Journals, yokes, welding flanges, clevises, also commercial forgings of various types and designs.
(c) Machining facilities.

See advertisement, Page 304

Pettibone Mulliken Corp., 4710 W. Division St., Chicago.

(a) Closed-die drop, upset and hammer forgings in alloy and carbon steels; drop to 25 lb, upset to 5 in. in diam.
(b) Automotive, agricultural, aircraft, railroad parts, etc.
(c) Machining and heat-treating.

Pittsburgh Forgings Co., Riverside Div., Jackson, Mich.

(a) Closed-die drop forgings, from 3 to 70 lb.
(b) Specialty, automotive hubs, gears, flanges, tractor wheels and various round hammer upset forgings.
(c) Complete facilities.

Pittsburgh Forgings Co., Thorne street, Coraopolis, Pa.

(a) Closed-die drop and upset forgings of carbon, alloy and stainless steel; from 1 oz to 300 lb.
(b) Automotive, farm equipment, tractor, railroad, etc.
(c) Milling, drilling, tapping; full heat treating.

Pittsburgh Trolley & Forge Co., 117 Water St., Pittsburgh.

(a) Forgings in carbon and alloy steel; to 2000 lb.
(b) Spindles, shafts, gears, rings, etc.
(c) Complete facilities.

Poor & Co., Canton Forge & Axle Works, 2027 Dueber Ave., S. W., Canton, O.

(a) Closed-die drop and upset forgings in carbon and alloy steels, 1 to 350 lb.
(b) Spindles, levers, gears, etc.
(c) Heat-treating facilities.

Porter Forge & Furnace Inc., 6 Ashland St., Everett, Mass.

(a) Closed-die drop forgings of standard and special steels and metals.
(b) To customers' specifications.
(c) Complete heat-treating facilities.

Portland Forge & Fdry. Co., Portland, Ind.

(a) Closed-die, board hammer, press, and upset forgings of steel bars, to 60 lb.
(b) Gears, cranks, plates, etc.
(c) Complete facilities, annealing and cleaning.

R

Revere Copper and Brass Inc., 230 Park Ave., New York 17.

(a) Die pressed forgings, of brass, bronze, copper, nickel silver, cupro-nickel, silicon bronze (Herculoy), aluminum and magnesium.
(b) To customers' specifications.
(c) Complete facilities.

See advertisements, Pages 263-264

Rhode Island Tool Co., 148 W. River St., Providence, R. I.

(a) Closed-die drop forgings of carbon, alloy and stainless steels, 10 in. diam, 1½ in. thick; 2 in. diam, 18 in. long.
(b) Bolts and nuts and screw machine products.
(c) Heat-treating facilities.

Rockford Drop Forge Co., 1033 Ninth St., Rockford, Ill.

(a) Drop forgings.
(b) Automotive and industrial clutches, etc.
(c) Information not available.

Rome Mfg. Co. Div., Revere Copper & Brass Inc., Railroad St., Rome, N. Y.

(a) Hot-pressed forgings in brass, copper and related alloys; aluminum and magnesium.
(b) To customers' specifications.
(c) Complete facilities.

S

St. Paul Foundry & Mfg. Co., St. Paul, Minn.

(a) Hammered forgings, of mild steel, up to 100 lb.
(b) To customers' specifications.
(c) Machining facilities.

Salem Tool Co., The, 767 S. Ellsworth Ave., Salem, Ohio.

(a) Hammer and pressed forgings of carbon steel, made of 1½ in. square steel and smaller.
(b) Mining tools.
(c) Machining, stamping, punching, fabricating, assembling and painting.

Scovill Mfg. Co., Waterbury, Conn.

(a) Made-to-order nonferrous forgings from brass, bronze, copper and aluminum.
(b) To customers' specifications.
(c) Complete facilities.

See advertisement, Page 295

Shuler Axle Co. Inc., 2901 S. Second St., Louisville, Ky.

(a) All type forgings in carbon and alloy steel, 1 to 300 lb.
(b) Automotive and trailer axles, also heavy-duty two-shoe brakes.
(c) Complete facilities.

Shunk Mfg. Co., Auto Ave., Bucyrus, Ohio.

(a) Hammered and pressed steel forgings.
(b) To customers' specifications.
(c) Complete facilities.

Smith-Armstrong Forge, Inc., 1209 Marquette Rd., Cleveland.

(a) Hammered iron and steel forgings from 2 lb to 2000 lb.
(b) Gears, rings, shafting, camshafts, spindles, bars, flats, rounds and shaped work, etc.
(c) Complete facilities.

See advertisement, Page 314

Snell Mfg. Co., Fiskdale, Mass. (factory); 149 Washington St., Worcester, Mass. (office).

(a) Hammered and closed-die drop, carbon and alloy steel forgings, ¼ to 1¼ lb.
(b) Ship augers, wood boring tools, etc.
(c) Heat-treating facilities.

Southern Saw Works Inc., East Point Rd., Atlanta, Ga.

(a) Drop hammer forgings in carbon and alloy steels to approximately ½ lb, depending on design and shape.
(b) Bits and shanks for inserted tooth saws, wrenches, commercial per specifications.
(c) Heat-treating facilities.

Spencer Mfg. Co., Spencer, O.

(a) Rolled and upset forgings.
(b) Axle forgings industrial shafts, etc.
(c) Complete facilities.

Standard Forgings Corp., Railway Exchange Bldg., Chicago 4.

(a) Hammered and closed-die drop forgings of steel, from 5 to 300 lb.
(b) Automotive, tractor, farm, industrial and railroad equipment.
(c) Heat treating.

Standard Steel Works Div., The Baldwin Locomotive Works, Burnham, Mifflin Co., Pa.

(a) Hammered and pressed forgings of all SAE, ASTM and AISI analyses; from 35 to 50,000 lb. (rough machined), 44 in. max diam, 42 in. max length. Also weldless steel ring type forgings and solid steel gear blanks, etc. Ring min ID 15 in., max diam 144 in. OD.
(b) Axles, crank pins, connecting rods, etc. for railroad industry; also industrial forgings such as shafts, rotor spindles, pinion blanks and pinion shafts, etc.
(c) Machining and heat treating facilities.

Steel, R., & Sons Inc., 4221 Ninth St., Long Island City 1.

(a) Carbon and alloy steel hammered forgings in 10 in. square or round, and under.
(b) Various.
(c) Machining and heat treating.

Steel Improvement & Forge Co., 970 E. 64th St., Cleveland.

(a) Closed-die drop hammer, upset and press forging.
(b) Machine tool, aircraft, automotive, truck and tractor, marine and coal industries.
(c) Complete facilities.

Storms Drop Forging Co., P. O. Box 2050, Springfield, Mass.

(a) Drop forgings, from fraction of ounce to 50 lb. in all grades of forgeable materials; also hot-pressed brass forgings.
(b) To customers' specifications.
(c) Complete heat treating facilities.

Struthers Wells Corp., Titusville Forge Div., Titusville, Pa.

(a) Hammered and pressed forgings, in all grades of carbon and alloy steels, up to 30 tons in diam up to 50 in.

(b) Crankshafts, shafts, pinions, spindles, etc.

(c) Machining, finishing and heat treating.

T

Taylor Forge & Pipe Works, P. O. Box 485, Chicago.

(a) Drop, upset and hammer forgings of carbon and alloy steels, some nonferrous metals, to 114 in. OD.

(b) Flanges, rings, nozzles, necks, gear blanks, etc.

(c) Complete facilities.

Taylor-Wharton Iron & Steel Co., (Easton, Pa. plant), High Bridge, N. J.

(a) Pierced and drawn forgings to 13 in. in diam., specializing in high-pressure gas cylinders.

(b) To customers' specifications.

(c) Complete facilities.

Titan Metal Mfg. Co., Bellefonte, Pa.

(a) Pressed forgings, in brass and bronze alloys, from ¼ oz to 100 lb.

(b) Valve parts, electrical parts, refrigerator parts, instrument parts, etc.

(c) Machining and heat treating.

Transue & Williams Steel Forging Corp., Alliance, O.

(a) All sizes and types of closed-die drop forgings from 1 oz to 1000 lb, of carbon steels, alloys and nonferrous metals.

(b) Various sizes and types of connecting rods, crankshafts camshafts, bearing caps, driveshafts and gears.

(c) Complete heat treating.

Tube Turns (Inc.), 224 E. Broadway, Louisville 1, Ky.

(a) Closed-die, upset and press forgings of steel and light metals; upsetters in sizes from 3 to 9 in.; presses up to 4000 tons.

(b) Radial and liquid-cooled aircraft automotive and diesel engine parts, truck, heavy duty equipment parts and various forgings of other types.

(c) Complete facilities.

U

Union Forging Co., Endicott, N. Y.

(a) Closed-die drop and press forgings.

(b) Automotive parts.

(c) Heat-treating facilities.

Unit Drop Forge Div. of Fuller Mfg. Co., 1903 South 62nd St., West Allis, Wis.

(a) Hammered, drop and upset steel and bronze forgings, 1 to 400 lb.

(b) Transmission countershaft gears.

(c) Heat-treating facilities.

V

Vlchek Tool Co., 3001 E. 87th St., Cleveland.

(a) Drop steel forgings, to 3 lb.

(b) To customers' specifications.

(c) Complete machine shop, automatic furnace.

Vulcan Steam Forging Co., 237 Rano St., Buffalo 7.

(a) Carbon, alloy, tool and stainless steel open die forgings.

(b) Rings, bars, disks, hubs, blocks, shafts, crankshafts, gear blanks, etc.

(c) Machining and heat treating.

W

Wilcox Mfg. Co., D., N. Chestnut & E. Allen Sts., Mechanicsburg, Pa.

(a) Closed-die drop forgings of alloy and steel, 1 oz to 30 lb.

(b) Automotive, railroad, farm and marine equipment, pump parts, pipe flanges, gears, connecting rods, crankshafts, shackles, clamps, bolts, etc.

(c) Heat-treating facilities.

Williams, J. H. & Co., 400 Vulcan St., Buffalo.

(a) Drop forgings in steel and nonferrous metal from ½ oz to 100 lb.

(b) Structural forged parts, gears, levers, cams, cranks, etc., for machine tools, gas engines, compressors, aircraft, automotive, etc.

(c) Complete facilities.

See advertisement, Page 306

Wyman-Gordon Co., Worcester, Mass., and Harvey, Ill.

(a) Closed-die drop hammer, upset and press forgings in steel and aluminum from 5 to 500 lb.

(b) Automotive and aviation.

(c) Heat-treating facilities.

Machine Die Castings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of die castings; (b) Names of die-cast parts customarily produced; and (c) Machining, finishing and assembling facilities

A

AC Spark Plug Div., General Motors Corp., 1300 N. Dort Highway, Flint, Mich.

(a) Zinc base die castings, from small speedometer parts to castings 26 x 20 in.

(b) Automotive and aircraft parts.

(c) Complete facilities.

Accurate Die Casting Co., The, 3089 East 80th St., Cleveland 4.

(a) Zinc and aluminum base alloys; zinc to 15 lb, and aluminum to 7 or 8 lb.

(b) To customers' specifications.

(c) Complete facilities.

Advance Pressure Castings Inc., 34 N. 15th St., Brooklyn 22, N. Y.

(a) Aluminum, zinc, copper, silicon and magnesium; aluminum 3 lb max and zinc 8 lb max.

(b) All types of machine parts.

(c) Machining facilities.

Aluminum Co. of America, 1940 Gulf Bldg., Pittsburgh.

(a) Aluminum alloy and zinc die castings, all types and sizes.

(b) To customers' specifications.

(c) Complete finishing facilities.

See advertisements, Pages 267, 271 and 287

The American Brass Co., Waterbury 88 Conn.

(a) Alloy 624 and Alloy 1026; max wt 3 to 3½ lb, in any shape within a 6-in. dia. circle, or a piece approx. 9 in. long.

(b) Electrical, radio, aircraft, etc.

(c) None.

See advertisements, Pages 297-298

American Magnesium Corp., 2210 Harvard Ave., Cleveland.

(a) High pressure die castings in standard magnesium die casting alloy in any size.

(b) To customers' specifications.

(c) None.

See advertisement, Page 145

Aurora Metal Co., 614 W. Park Ave., Aurora, Ill.

(a) Aluminum bronze and silicon bronze vacuum die castings.

(b) To customers' specifications; including such parts as automotive, home appliance, farm equipment, machine tool, etc.

(c) Information not available.

B

Badger Die Casting Co., 201 W. Oklahoma Ave., Milwaukee 7.

(a) Zinc and aluminum alloy die castings, from very small to 10 lb in zinc and 5 lb in aluminum.

(b) Aircraft instrument parts, small gasoline engine parts, carburetors and other parts.

(c) Complete facilities.

Benton Harbor Malleable Industries, Benton Harbor, Mich.

(a) Special high-grade zinc die castings, not to exceed 5 lb.

(b) To customers' specifications.

(c) Machining.

Borman Castings Corp., St. Joseph, Mich.

(a) Zinc, aluminum, magnesium and lead die castings in sizes corresponding to a 6-lb zinc casting.

(b) Washing machine, automotive and aircraft parts.

(c) Limited facilities.

C. D

Chicago Expansion Bolt Co. Inc., 2240 W. Ogden Ave., Chicago 12.

(a) Lead or lead alloy die castings, in any size.

(b) To customers' specifications.

(c) No information available.

Cincinnati Die Casting Co., 2117 Spring Grove Ave., Cincinnati.

(a) Zinc, aluminum and brass die castings; 10 lb in zinc, 8 lb in aluminum and ½ lb in brass.

(b) Aircraft and ordnance parts.

(c) Machining and finishing facilities.

Cleveland Hy-Pressure Casting Co., 5400 Brookpark Rd., Cleveland 9.

(a) Aluminum and zinc base alloy die castings, up to 5 or 6 lb in aluminum, and 10 to 12 lb in zinc.

(b) To customers' specification for automotive, appliance, radio and refrigeration industries, etc.

(c) Complete facilities.

Congress Die Casting Div., 3750 E. Outer Drive, Detroit.

(a) Zinc alloy die castings, to 10 lb; also aluminum.

(b) Pulleys, flexible couplings, vending machine, washing machine, radio, woodworking machine and automotive parts.

(c) Complete facilities.

Dayton Die Casting Co., 111 Front St., Dayton 2, O.

(a) Aluminum, brass, zinc and lead die castings; 3 lb in aluminum and approx 2 lb each in other alloys.

(b) All types of machine parts.

(c) Complete facilities.

DeCardy Bros. Co., 1806 North Keeler Ave., Chicago 39.

(a) Zinc and lead base alloy die castings; small in size (ordinarily less than 5 oz).

(b) To customers' specifications.

(c) No information available.

Doehler-Jarvis Corp., 386 Fourth Ave., New York. (Plants at Chicago, Batavia, N. Y., Toledo, O., Pottstown, Pa., and Grand Rapids, Mich.)

(a) Zinc, aluminum, brass, magnesium, tin and lead die castings.

(b) All types of machine parts.

(c) Machining facilities; finishing for nickel, chrome and copper; and plating and enameling.

Dollin Corp., 610 S. 21st St., Irvington 11, N. J.

(a) All sizes, in aluminum and zinc alloys.

(b) All types of die-cast parts.

(c) Machining and trimming facilities; cold chamber, high-pressure and other high speed and special equipment.

Dow Chemical Co., The, Midland, Mich.

(a) Dowmetal, magnesium alloy, die castings.

(b) All types of aircraft, automotive and other machine parts.

(c) None.

E. F. G

Electric Auto-Lite Co., Die Casting Div., Woodstock, Ill.

(a) Zinc and aluminum die castings, in sizes approx. 18 x 24 x 6 in. max.

(b) Brackets, covers, housings, bases, gears, motor parts, trim, etc.

(c) Machining and finishing facilities.

Federal Die Casting Co., 2222-32 Elston Ave., Chicago 14.

(a) Zinc and aluminum die castings, 16 lb in zinc and 3 lb in aluminum (cold chamber).

(b) Parts for automobiles, stokers, airplanes, household appliances, and industrial equipment.

(c) Complete facilities.

Federal-Mogul Corp., 11031 Shoemaker Ave., Detroit.

(a) Tin and lead base, medium and small die castings.

(b) Primarily bearings and bushings.

(c) Complete facilities.

See advertisement, Page 299

Gerity-Michigan Die Casting Co., 8651 E. Seven Mile Rd., Detroit 12. (Adrain Div., 1365 E. Beecher St., Adrain, Mich.)

(a) Zinc die castings to 48 lb.

(b) Automotive and miscellaneous parts.

(c) Complete facilities.

H

Harvill Corp., 6251 W. Century Blvd., Los Angeles 43.

(a) Aluminum, magnesium, manganese-bronze

and zinc alloy die castings, up to approximately 16 x 24 in. and 8 lb in weight.
(b) All types of machine parts.
(c) Machining.

Heick Die Casting Corp., 6550 W. Diversey Ave., Chicago 35.

(a) Aluminum and zinc alloy die castings, from ½ oz to 4 lb.
(b) Brackets, pulleys, levers, frames, etc.
(c) Complete assembling and machining facilities.

Hoover Co., The, Maple and McKinley Sts., North Canton, O.

(a) Aluminum and zinc die castings, to 24 in. square.
(b) To customers' specifications.
(c) Complete facilities.

K, L

Krone Die Casting Co., Paul, 1815 N. Kostner Ave., Chicago 39.

(a) Zinc and aluminum alloy die castings, zinc to 5½ lb and aluminum to 2 lb.
(b) All types of die cast parts, machine or ornamental.
(c) Machining, and tool and die department

Latrobe Die Casting Co., North and Unity Sts., Latrobe, Pa.

(a) Zinc, aluminum, tin and lead alloy die castings; aluminum, 5 lb; zinc, 8 lb; tin and lead, 2 lb.
(b) All types in weight range.
(c) Machining and finishing facilities; production under X-ray and laboratory control.

M

Madison-Kipp Corp., 210 Waubesa St., Madison, Wis.

(a) Zinc and aluminum die castings, all sizes
(b) Automotive, household appliances, railway, ordnance parts, etc.
(c) Complete facilities.

See advertisement, Page 156

Mason, L. E., Co., 98 Business St., Hyde Park 36, Mass.

(a) Aluminum and zinc castings.
(b) Large, to customers' specifications
(c) Complete facilities.

McGill Mfg. Co., Metal Div., Valparaiso, Ind.

(a) Aluminum, bronze and special hard bronze die castings, from ½ oz to 7 lb. Hydraulic pressure castings of hard yellow brass and silicon bronze, ½ oz to 1 lb.
(b) Great variety of machine parts including gears, levers, and other corrosion-resistant machine parts.
(c) Complete facilities.

Michigan Die Casting Co., 8651 E. 7 Mile Rd., Detroit 12.

(a) Zinc and aluminum die castings; to 25 lb in zinc, and 10 lb in aluminum.
(b) Automotive and aircraft parts.
(c) Complete facilities.

Milwaukee Die Casting Co., 1015 N. Fourth St., Milwaukee 3.

(a) Zinc to 5 lb; aluminum to 4 lb; lead. tin to 14 lb.
(b) Motor cases, electrical apparatus, faucet handles, radio parts, automotive parts, etc.
(c) Machining and finishing facilities.

Monarch Aluminum Mfg. Co., Dycast Products Div., 9301 Detroit Ave., Cleveland.

(a) Zinc and aluminum base alloy die castings; in zinc to approx 15 lb, in aluminum, approx 5 lb. (Also permanent mold and sand castings.)
(b) Automotive, radio, refrigeration, electrical cases, vending machine, etc.
(c) Limited machining and assembling facilities.

Mt. Vernon Die Casting Corp., 118 Pearl St., Mount Vernon, N. Y.

(a) Aluminum and zinc; up to 18 lb in zinc, and 10 lb in aluminum.
(b) Machine parts.
(c) Machining facilities.

N

National Lock Co., 1902 Seventh St., Rockford, Ill.

(a) Zinc die castings to 12 in.
(b) To customers' specifications.
(c) Complete facilities.

National Molded Products Co., 1130 E. 22nd St., Cleveland 17.

(a) Zinc and aluminum die castings up to 10 lbs.
(b) To customers' specifications.
(c) Light machining and assembling facilities

New Products Corp., 448 North Shore Drive, Benton Harbor, Mich.

(a) Aluminum, brass, magnesium and zinc die castings; up to 5 lb in aluminum; 1 lb in brass; 15 lb in zinc; and 2 lb in magnesium.
(b) Airplane carburetor parts, rotary pump assemblies, fuse parts, airplane air-speed indicators, etc.
(c) Complete facilities.

Newton-New Haven Co., New Haven 4, Conn.

(a) Aluminum, magnesium and zinc alloy die castings, up to medium-large.
(b) Aircraft instrument parts.
(c) Complete facilities.

P, R

Parker White Metal & Machine Co., McKinley Ave., at 23rd St., Erie, Pa.

(a) Zinc and aluminum base die castings in any size.
(b) All types of machine parts.
(c) Complete facilities.

Phoenix Die Casting Co., 21 Illinois St., Buffalo.

(a) Aluminum, lead, tin and zinc-base alloy die castings; no extra large sizes.
(b) To customers' specifications.
(c) None.

Precision Castings Co., Inc., Fayetteville, N. Y. (Branch, Cleveland, O.; Die Shop, Syracuse, N. Y.; Plating plant, Kalamazoo, Mich.)

(a) Aluminum, magnesium and zinc castings from fraction of ounce to 26 lb.
(b) Automotive, household appliances, outboard motors, etc., and to customers' specifications.
(c) Machining, assembling facilities.

Pressure Castings Inc., 21500 St. Clair Ave., Cleveland.

(a) Zinc and aluminum alloy die castings to 24 x 24 in.
(b) To customers' specifications.
(c) Finishing and machining facilities.

Rupert Diecasting Co., 1655 Cleveland Ave., Kansas City, Mo.

(a) Zinc and aluminum alloy die castings, from 1 oz to 7 lb.
(b) Parts for automobiles, washing machines, electrical equipment, lawn mowers, household appliances and automatic equipment.
(c) Machining and finishing facilities

S, T

Schultz Die Casting Co., 1810 Clinton St., Toledo, O.

(a) Zinc base die castings.
(b) Automotive, etc.
(c) Machining and finishing facilities

Sterling Die Casting Co., 743 39th St., Brooklyn 32, N. Y.

(a) All sizes of zinc and aluminum die castings.
(b) All types of machine parts
(c) Machining facilities.

Superior Die Casting Co., 17825 Euclid Ave., Cleveland.

(a) Zinc and aluminum alloy die castings
(b) Appliance, various machine parts.
(c) Information not available.

Titan Metal Mfg. Co., Bellefonte, Pa.

(a) Brass and bronze die castings up to 11 lb
(b) Electrical, refrigeration and miscellaneous parts.
(c) Machining facilities.

Toman, E., & Co., 2621 W. 21st Place, Chicago 8.

(a) All types of zinc base die castings from ½ oz to 8 lb.
(b) To customers' specifications.
(c) Complete facilities.

Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis 14.

(a) Zinc, tin and lead alloys, up to 5 lb.
(b) Large variety of machine parts.
(c) All, except plating.

W, Y

Warner Mfg. Co., 666 Hawthorne St., Glendale 4, Calif.

(a) Aluminum, manganese-bronze and zinc die castings, up to 3 lb in aluminum, 5 lb in manganese-bronze, and 8 lb in zinc.
(b) All types of machine parts.
(c) Complete facilities.

Western Die Casting Co., 4065 Hollis St., Emeryville 8, Calif.

(a) Aluminum, magnesium, manganese-bronze, zinc and lead die castings in all sizes; up to 20 lb in zinc.
(b) Aircraft parts and others to customers' specifications.
(c) Complete facilities.

Yale & Towne Mfg. Co., The, 200 Henry St., Stamford, Conn.

(a) Zinc base alloy No. 3 die castings; small and medium, to approx 3 x 5 in.
(b) Rim latches, automotive locks, etc.
(c) Finishing and assembling facilities.

Custom Molders of Plastics

Reference letters beneath addresses of companies refer to: (a) Types of materials utilized; and (b) Names of machine parts customarily molded

A

Accurate Molding Corp., 35-20 48th Ave., Long Island City 1, N. Y.

(a) BAKELITE, DUREZ, RESINOX, BEETLE and PLASKON.

(b) Terminal blocks, electrical control boxes, terminal plates, motor replacement switches, cable connectors, instrument housing, commutators, etc.

Ackerman Plastic Molding, 986 East 200th St., Cleveland 19.

(a) Compression molding of all thermosetting materials.

(b) Mechanical, electrical and industrial parts.

Advance Molding Corp., 54 W. 21st St., New York.

(a) TENITE I and II, LUCITE, cellulose acetate, and other thermoplastics.

(b) All custom molded injection parts.

Alden Products Co., 117 N. Main St., Brockton 64, Mass.

(a) Any phenol-formaldehydes such as BAKELITE, RESINOX, MAKALOT, DUREZ, etc.

trusion and transfer molded parts.

American Insulator Corp., New Freedom, Pa.

(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, LUMARITH, TENITE, PLASTACELE, POLYSTYRENE, LUCITE, VINYLITE, ETHOCEL, PLEXIGLAS, NIXONITE, NYLON, FORTICEL, FIBESTOS, and cold-molded composition.

(b) To customers' specifications.

American Molding Co., 355 Fremont St., San Francisco 5.

(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, RESINOX, FIBESTOS, CRYSTALITE, PLASTACELE, LUCITE, POLYSTYRENE and ETHOCEL.

(b) Technical, automotive, electrical, aircraft, etc. Compression, injection, and extrusion and transfer molded parts.

American Phenolic Corp., 1830 S. 54th Ave., Chicago 50.

(a) BAKELITE, DUREZ, AMPHENOL, and transparent POLYSTYRENE.

(b) Electrical small sections, special rods and tubes, electrical connectors, etc., for aircraft and radio.

American Plastics Corp., 225 W. 34th St., New York 1.

(a) Cellulose acetate, cellulose acetate butyrate, Methyl methacrylate, polystyrene, vinyl compounds, urea and phenolic molding powders.

(b) Extruded shapes, ribbons, tubes, rods, etc., by injection and compression molding.

American Products Mfg. Co., Oleander cor. Dublin Sts., New Orleans 18.

(a) Cellulose acetates, ethyl cellulose, and aceto-butyrates.

(b) Cover shields.

Amos Molded Plastics Div., Amos Thompson Corp., Edinburg, Ind.

(a) ETHOCEL, cellulose acetate, butyrate, FORTICEL, POLYSTYRENE, STYRAMIC and acrylics.

(b) Nozzles, handles, couplings, knobs, lenses, frames, parts for refrigerators, vacuum cleaners, household appliances, etc.

Anchor Plastics Co., 533-541 Canal St., New York 13.

(a) VINYLITE, LUCITE, PLEXIGLAS, and cellulose esters are extruded.

(b) To customers' specifications.

Anifinsen Plastic Molding, Aurora, Ill.

(a) All types of plastics which can be compression or injection molded.

(b) To customers' specifications.

Armstrong Cork Co., Industrial Div., Lancaster, Pa.

(a) Cork compositions, Cork-and-synthetic-rubber compositions, synthetic rubber compounds, cork-and-rubber compositions, rag felt papers, fibrated leather, and other fiber sheet packing materials.

(b) Gaskets, oil-retaining rings, washers, valve disks, friction wheels, strips, blocks, disks, ribbon, polishing wheels, handles, roll coverings, packings, seals, feed rolls, friction grips, bushings diaphragms, anti-skid parts, glazing strip, vibration-damping pads, etc.

See advertisement, Page 135

Atlantic Plastics, 4732 St. Clair Ave., Cleveland.

(a) BAKELITE, BEETLE, PLASKON, DUREZ, RESINOX, TENITE, LUCITE, PLASTACELE, LUMARITH, THIOKOL and other synthetics.

(b) Safety supply parts, lighting and electrical, radio, chemical, mechanical, etc. All types of injection or compression molded parts.

Auburn Button Works Inc., Auburn, N. Y.

(a) All kinds of plastic materials.

(b) All types of industrial parts.

B

Berkander Inc., George F., 891 Broad St., Providence 7, R. I.

(a) TENITE, LUMARITH and PLASTACELE.

(b) To customers' specifications.

Boonton Molding Co, 326 Myrtle Ave., Boonton, N. J. (Sales office: 122 E. 42nd St., New York.)

(a) All kinds of plastic molding materials.

(b) Parts molded by all methods to customers' specifications.

Breeze Corporations, Inc., 24 S. Sixth St., Newark 7, N. J.

(a) All types of plastic materials.

(b) To customers' specifications.

Breyer Molding Co., 2536 W. Lake St., Chicago.

(a) All compression and injection materials.

(b) All phenolic machine parts, sockets, plugs, etc.

Butterfield, T. F., Inc., 56 Rubber Ave., Naugatuck, Conn.

(a) LUCITE, TENITE, BAKELITE, DUREZ, BEETLE, MELAMINE, MAKALOT, RESINOX, FIBESTOS, PLASKON, LUMARITH and PLASTACELE.

(b) Molded electrical insulations and housings.

C

California Plastic Molding Co., 1702 E. 61st . . . St., Los Angeles 1.

(a) BAKELITE, PLASKON, BEETLE, DUREZ, MONSANTO, etc., all thermosetting materials.

(b)Plastic industrial parts.

Capac Plastics Inc., Capac, Mich.

(a) CAPAC laminated plastic.

(b) Structurals and shapes, refrigeration, automotive, etc.

Carter Products Corp., 6921 Carnegie Ave., Cleveland 3.

(a) TENITE I and II, POLYSTYRENE, VINYLITE and ethyl cellulose.

(b) Tubing, rod and various shapes for all types of machines.

Castle Rubber Co., Box 589, Butler, Pa.

(a) Rubber and synthetic rubber.

(b) Automotive and various industrial rubber-to-metal parts.

Celluplastic Corp., 50 Ave. L, Newark, N. J.

(a) All types of thermoplastics. Injection machines range from 9 oz to 22 oz.

(b) To customers' specifications.

Central Die Casting & Mfg. Co. Inc., 2935 W. 47th St., Chicago.

(a) TENITE, LUMARITH, and all other thermoplastics.

(b) All types of molded parts to 8 oz. in weight.

Chamberlain Engineering Corp., Akron, O.

(a) All molding materials.

(b) To customers' specifications.

Chicago Die Mold Corp., 4001 Wrightwood Ave., Chicago 39.

(a) TENITE, BAKELITE, PLASKON, LUCITE, STYRON, etc.

(b) To customers' specifications.

Chicago Molded Products Corp., 1028 N. Kolmar Ave., Chicago.

(a) All commercial synthetic plastics, both thermosetting and thermoplastic types.

(b) Automotive, aviation, industrial, electrical, mechanical, scientific, surgical, electrical and other parts molded to special order.

Cincinnati Advertising Products Co., Plastics Div., 3274 Beekman St., Cincinnati 23.

(a) PLASTACELE, TENITE, LUMARITH, LUCITE, CRYSTALLITE, LUSTRON, POLYSTYRENE and VINYLITE.

(b) All types of injection molded machine parts.

Cincinnati Molding Co., 2037 Florence Ave., Cincinnati 6.

(a) BAKELITE, RESINOX, DUREX, PLASKON, BEETLE or any thermosetting plastic.

(b) Electrical, mechanical or decorative parts.

Claremould Plastics Co., 200 Wright St., Newark 5, N. J.

(a) TENITE I and II, LUMARITH, PLASTACELE, LUCITE and POLYSTYRENE.

(b) All types of custom molded parts.

Cleveland Plastics Inc., 1017 Euclid Ave., Cleveland.

(a) BAKELITE, BEETLE, CRYSTALITE, DUREZ, ETHOCEL, LUCITE, LUMARITH, MONSANTO, PLASKON, PLASTACELE, RESINOZ, STYRON and TENITE.

(b) To customers' specifications.

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

(a) All plastic materials.

(b) All types of machine parts.

Columbus Plastic Products Inc., 1625 W. Mound St., Columbus, O.

(a) Cellulose acetate. cellulose acetate butyrate polystyrene ethyl cellulose, polythene, and methyl methacrylate.

(b) All types of injection molded parts to customers' specifications such as knobs, handles. nameplates, housings, electrical parts, etc.

Commonwealth Plastic Co., 98 Adams St., Leominster, Mass.

(a) Cellulose acetate, polystyrene, ethyl cellulose, CATALIN and LUCITE.

(b) All types of parts which can be injection molded or extruded. Injection, from 1 to 16 oz.

Compression Molding Co., 1329 S. Vandeventer, St. Louis 10.

(a) PLASKON RESINOX, DURITE, BAKELITE, BEETLE, etc.

(b) Compression molded plastic parts.

Connecticut Hard Rubber Co., 407 E. St., New Haven, Conn.

(a) Synthetic rubbers, all types; hard rubber.

(b) Seals, gaskets, electrical insulation parts, etc.

Connecticut Plastic Products Co., 70 W. Liberty St., Waterbury, Conn.

(a) Cellulose acetate, cellulose butyrate, ethyl cellulose. polystyrene, methyl methacrylate, and polyethylene.

(b) Lenses, flashlight parts, etc.

Consolidated Molded Products Corp., 309-29 Cherry St., Scranton 2, Pa.

(a) All types of molding material for compression, transfer and injection molding.

(b) Various machine parts.

Continental Can Co. Inc., Plastics Div., Cambridge, Ohio.

(a) BAKELITE. PLASKON. TENITE, LUMARITH, DUREZ, LUCITE, RESINOX, POLYSTYRENE and low-pressure contact resins.

(b) All types of compression and injection parts to customers' specifications.

Continental Diamond Fibre Co., Newark 23, Del.

(a) CELORON, DILECTO, DIAMOND FIBRE, VULCOID, DILECTENE, MICABOND, etc.

(b) Gears couplings, aircraft parts, electrical insulating parts, mechanical and chemical resistant parts.

Continental Plastics Corp., 308-314 W. Erie St., Chicago.

(a) Acetate butyrate, LUMARITH, POLYSTYRENE, ETHOCEL and LUCITE.

(b) Dummy spark plugs, refrigerator parts, cable clamps, bobbins, etc.

Cruver Mfg. Co., 2456-60 Jackson Blvd., Chicago.

(a) All thermoplastic materials.

(b) Plastic injection custom molded parts, industrial and decorative.

Cutler-Hammer Inc., 315 N. 12th St., Milwaukee.

(a) THERMOPLAX and PYROPLAX.

(b) Terminal blocks, insulators, switch bases, knobs, handles, insulating bushings, arc shields and miscellaneous electrical insulating forms and parts requiring high heat resistance.

D, E

Davies Molding Co., Harry, 1428 N. Wells St., Chicago 10.

(a) Phenol-formaldehyde and synthetic ureas.

(b) Stock molded parts.

Davis Plastics Co., Joseph, Schuyler Ave., ft. Quincy, Arlington, N. Y.

(a) All thermoplastic materials, cellulose nitrate, cellulose acetate, cellulose acetobutyrate, ethyl cellulose and Vinylite.

(b) Bushings, lenses. insulating tubing (flexible and rigid), sheets, rods, etc.

Detroit Macoid Corp., 12340 Cloverdale Ave., Detroit 4.

(a) Thermoplastic materials by extrusion and injection molding.

(b) To customers' specifications.

Diemolding Corp., Canastota, N. Y.

(a) BAKELITE. DUREZ, PLASKON, BEETLE, or any thermosetting material.

(b) Control handles or knobs. small bases and plates, pulleys, pushbuttons, housings, etc.

Dillon-Beck Mfg. Co., 485 So. 21st St., Irvington 11, N. J.

(a) All thermoplastic injection molding materials.

(b) Insulators. thread protectors, sextants, as well as parts to customers' specifications.

Dimco Plastics, 207 E. Sixth St., Dayton 2, O.

(a) BAKELITE, DUREZ, PLASKON, TENITE, MELMAC. PLASTACELE, NIXONITE. POLYSTYRENE, VINYLITE, LUCITE. MASURON, and similar plastic materials.

(b) Aircraft control parts. knobs. solenoid coil spools. handles for machine tools, electrical parts, etc.

Eastern Plastics Inc., 3000 Penn Ave., Pittsburgh 1.

(a) All thermosetting materials.

(b) To customers' specifications.

Eclipse Moulded Products Co., Milwaukee.

(a) All plastic materials.

(b) Compression, injection and extrusion molded parts.

Erie Plastics Co., 1304 Cranberry St., Erie, Pa.

(a) Thermoplastic materials.

(b) To customers' specifications.

Erie Resistor Corp., 644 W. 12th St., Erie, Pa.

(a) All extrusion and injection molding of thermosetting materials.

(b) Aircraft, automobile, radio, refrigerator parts, three-dimensional knobs, bezels, etc.; also plastic molded around glass for instrument faces.

Eureka Button Co., 892 Broadway, New York.

(a) BAKELITE and urea materials.

(b) All types of compression molded parts.

Extruded Plastics Inc., New Canaan Ave., Norwalk, Conn.

(a) Cellulose acetate butyrate (TENITE II), TULOX, INTERLOX, vinyl resins, ethyl cellulose and POLYETHYLENE.

(b) Seamless plastic tubing from ⅛-in. to 2 in. OD for oil lines, air lines, etc., also extruded plastic shapes.

F

Federal Tool Corp., 412 North Leavitt St., Chicago.

(a) Materials used in injection molding.

(b) To customers' specifications.

Felsenthal & Sons, G., 4110 W. Grand Ave., Chicago 51.

(a) All thermoplastic materials.

(b) All thermoplastic parts for automobiles, radios, coin-operated machines, refrigerators, electrical appliances, general machinery, etc., including such items as dials. dial windows, calculators, computers. scale parts, recording machine parts, nameplates, pushbuttons, etc.

Firestone Industrial Products Co., Akron 17, O. (Plastic mfg. plant: Fall River, Mass.)

(a) All compression and injection molding materials.

(b) Lenses, plastics over metal, refrigerator trim, cabinets and housings, electrical parts, etc.

Franklin Plastics Div., Robinson Industries Inc., Franklin, Pa.

(a) Thermoplastic materials.

(b) Automotive, refrigerator. radio. industrial, household and business machine parts.

G

Garfield Mfg. Co., Garfield, N. J.

(a) BAKELITE. DUREZ, DURITE, HEMIT, GARIT and TEGIT.

(b) Hot and cold molded parts to customers' specifications.

Gemloid Corp., 7910-30 Albion Ave., Elmhurst, L. I., N. Y.

(a) PLEXIGLAS. LUCITE. TENITE I and II, PLASTACELE. STYRENE, SARAN, ETHOCEL, VINYLITE, etc.

(b) Gaskets, flexible and clear tubings, dials, knobs, etc.

General Electric Co., Chemical Dept., Plastics Divisions, 1 Plastics Ave., Pittsfield, Mass.

(a) TEXTOLITE (molded, laminated and cold-molded).

(b) All types to customers' requirements.
See advertisement, Page 303

General Industries Co., Elyria, O.

(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, TENITE, LUMARITH, PLASTACELE, LUCITE and CRYSTALITE.
(b) Special parts to customers' specifications.

General Products Corp., Union Springs, N. Y.

(a) BAKELITE, DUREZ, DURITE, RESINOX, PLASKON, BEETLE, MELMAC and rubber.
(b) Automotive ignition parts, electrical parts, radio, instrument cases, magneto motor parts and intricate custom moldings.

Gits Molding Corp., 4600 W. Huron St., Chicago.

(a) TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE, SARAN, VINYLITE, butyrates and ethyl cellulose.
(b) Radio knobs and cabinets, push-buttons, escutcheons, dials, supports and insulators.

Great American Plastics Co., 55 North St., Fitchburg, Mass.

(a) Acetate, butyrate, polystyrene, etc.—all materials used in injection process.
(b) To customers' specifications such as typewriter parts, knobs, etc.

Great American Plastics Co., 180 Pond St., Leominster, Mass.

(a) Thermoplastics materials.
(b) Parts made of sheets, rods and tubes, and special shapes by injection, hollow molding, forming and extruding.

Grigoleit Co., 740 E. North St., Decatur, Ill.

(a) BAKELITE, DUREZ, INDUR, PLASKON, TENITE and BEETLE.
(b) Molded closures, knobs, handles and injection molded parts.

H

Haas Co., The, Mendon, Mich.

(a) BAKELITE, PLASKON, DUREZ and other thermosetting materials.
(b) All types of custom molded parts.

Hopp Press Inc., 460 W. 34th St., New York 1.

(a) VINYLITE, cellulose acetate, ethylcellulose, and any material that can be injection molded or extruded.
(b) To customers' specifications.

I

Ideal Plastics Corp., 184-10 Jamaica Ave., Hollis 7, N. Y.

(a) All thermoplastic materials.
(b) To customers' specifications.

Illini Molded Plastics, 528 W. Chestnut, Hinsdale, Ill.

(a) BAKELITE, DUREZ, PLASKON and MONSANTO.
(b) Aircraft fairleads, grommets, connectors, adapters, bobbins and other electrical insulating components, water and steam valves, foot valves for the food industry, coil forms and plugs, and jack receptacles.

Imperial Molded Products Corp., 2927 W. Harrison St., Chicago.

(a) BAKELITE, RESINOX, DUREZ, MAKALOT, and PLASKON.
(b) Handles, knobs, controls, sub-assembly for mechanical working parts such as terminal blocks, insulators, contact blocks, housings, soda fountain parts, etc.
See advertisement, Page 268

Ingwersen Mfg. Co. Inc., 1800 S. Acoma St., Denver 10.

(a) RESINOX, TENITE, FIBESTOS, STYRON, SARAN, BAKELITE and VINYLITE.
(b) Various machine parts.

Injection Molding Corp., 115 Fourth Ave., New York.

(a) TENITE, LUCITE, LUMARITH, LUSTRON, STYRENE, PLASTACELE, etc.
(b) To customers' specifications.

Inland Mfg. Div., General Motors Corp., 2727 Inland Ave., Dayton 1, Ohio.

(a) All types of molding materials.
(b) To customers' specifications.

Insulation Mfg. Co. Inc., 11 New York Ave., Brooklyn 16.

(a) BAKELITE, DUREZ, MAKALOT, RESINOX, LUCITE, CRYSTALITE, TENITE, LUMARITH, ELECTROSE, INSULATE, etc.
(b) Insulators and insulating parts, molded instrument and industrial parts.

Insulation Products Co., 504 North Richland St., Pittsburgh.

(a) BAKELITE, DUREZ, TENITE and PLASKON.
(b) Parts to customers' specifications.

J, K

Johnson Rubber Co., The, 111 Vine St., Middlefield, O.

(a) Molded rubber.
(b) Molded, extruded and cut parts.

Kampa Mfg. Co., 12132 W. Capitol Drive, Milwaukee.

(a) TENITE, STYRON, LUCITE, ETHYLCELLULOSE, LUMARITH and SARAN.
(b) Switch boxes, insulators and instrument case covers.

Keolyn Plastics Co., 2731 N. Pulaski Rd., Chicago 39.

(a) TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE, VINYLITE and other thermoplastics.
(b) To customers' specifications.

Kenilworth Plastics Molding Co., Kenilworth, N. J.

(a) BAKELITE and urea materials.
(b) All types of compression molded parts.

Kerr Co., R. W., 220-222 S. Burlington Ave., Hastings, Nebr.

(a) All thermosetting materials for compression molding.
(b) Scalp massagers, meter cases, and other parts to customer's specifications.

Kilgore Mfg. Co., Plastics Div., Westerville, O.

(a) Cellulose acetate, POLYSTYRENE, butyrate acetates, ureas and phenolics.
(b) Injection molded parts.

Klingman Co., P. O. Box 208, Leominster, Mass.

(a) TENITE, LUSTRON, STYRON, LUMARITH, LUCITE, cellulose acetate, etc.
(b) Any extruded, injection molded and fabricated parts.

Kirk Molding Co., F. J., Clinton, Mass.

(a) Thermoplastic materials.
(b) Parts which can be injection molded on 4 and 8 oz machines.

Kuhn & Jacob Molding & Tool Co., 1200 Southard St., Trenton 8, N. J.

(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, LUMARITH, etc.
(b) Compression molding of electrical, automotive, radio, airplane, instrument, permanent wave machine parts, etc.; also any type of injection molding.

Kurz-Kasch Inc., 1421 S. Broadway, Dayton, O.

(a) All types of thermosetting plastics.
(b) Radio instrument knobs, etc.

M

MacDonald Mfg. Inc., 536 Bedford Ave., New Baltimore, Mich.

(a) TENITE, ETHOCEL, LUMARITH, CEREX, LUCITE and POLYSTYRENE.
(b) To customers' specifications.

Mack Molding Co. Inc., Ryerson Ave., Wayne, N. J.

(a) BAKELITE, DUREZ, TENITE, BEETLE, LUMARITH, FIBESTOS and PLASKON.
(b) Parts to customers' specifications.

Master Plastic Molding Corp., 1609 N. Broadway, St. Louis 16.

(a) LUCITE, LUMARITH, ETHOCEL, STYRON and CEREX.
(b) All injection molded parts.

Mechanical Institute, 115 Cedar St., Boonton, N. J.

(a) Thermosetting and thermoplastic materials.
(b) Distributors, sockets, switches, etc.

Metal Specialty Co., 814 South L St., Richmond, Ind.

(a) ETHOCEL, TENITE, CRYSTALITE, LUCITE, POLYSTYRENE, LUMARITH, NIXONITE, etc.
(b) Automobile, radio and refrigerator parts.

Micamold Radio Corp., 1087 Flushing Ave., Brooklyn 6, N. Y.

(a) BAKELITE, PLASKON and acetates.
(b) Condensers and resistors.

Michigan Molded Plastics Inc., G and Baker Sts., Dexter, Mich.

(a) BAKELITE, DUREZ, TENITE, PLASTACELE, LUMARITH, PLASKON, LUCITE, SARAN and MONSANTO.
(b) Molded plastic parts, all types and sizes by compression, injection and extrusion.

Midwest Molding & Mfg. Co., 337 N. Whipple St., Chicago.

(a) BAKELITE, DUREZ, RESINOX, BEETLE and PLASKON.
(b) Terminal blocks, electrical parts, etc.

Mills Corp., Elmer E., 153 W. Huron St., Chicago 10.

(a) Thermoplastic materials including cellulose acetate, cellulose acetate butyrate, acrylates, methacrylates, styrenes, vinyls, vinylidene chloride, etc.
(b) Injection molding and extruding of machine parts.

Minnesota Plastic Corp., 366 Wacouta St., St. Paul 1, Minn.

(a) TENITE II, LUMARITH, PLASTACELE, FIBESTOS, LUSTRON, POLY-

STYRENE, STYRON, VINLYITE, LUCITE and PLEXIGLAS.
(b) Cream separator parts, milking machine parts, mechanical refrigerator parts, machine tool parts, etc.

Modern Plastics Corp., 489 N. Shore Drive, Benton Harbor, Mich.
(a) BAKELITE, DUREZ, RESINOX, LUCITE, PLEXIGLAS, TENITE, LUMARITH, STYRENE, melamine, ethyl cellulose, SARAN and CEREX.
(b) Radio, automotive, washing machine electrical and appliance parts.

Modglin Co., 3827 Verdugo Rd., Los Angeles.
(a) Cellulose acetates and polystyrenes.
(b) Injection molded machine parts.

Molded Insulation Co., 335 E. Price St., Philadelphia 44.
(a) All thermoplastic and thermosetting materials.
(b) Any compression or injection molded part. Compression presses to 300-ton capacity: injection molding presses to 22-oz capacity.

Molded Products Corp., 4533 W. Harrison St., Chicago 24.
(a) BAKELITE, DUREZ, RESINOX, PLASKON, TENITE, LUCITE, LUMARITH and POLYSTYRENE.
(b) Industrial, electrical, mechanical, scientific, automotive and radio parts to customers' specifications.

Monaplastics Inc., Branchville Center, Georgetown, P.O., Conn.
(a) Thermoplastic materials.
(b) To customers' specification. Specially equipped to handle insert moldings in one piece.

Monroe Auto Equipment Co., Hillsdale, Mich.
(a) Rubber materials.
(b) Extruded and injection molded parts.

N

National Lock Co., 1902 Seventh St., Rockford, Ill.
(a) DUREZ, BAKELITE, MAKALOT, RESINOX, TENITE, LUMARITH, PLASTACELE, LUCITE, PLEXIGLAS, ETHOCEL, MELMAC, PLASKON and BEETLE.
(b) Washing machine agitators, magneto rotors and ignition parts.

National Plastic Products Co., Odenton, Maryland.
(a) Acetates, aceto-butyrates, ethocels, polystyrenes, polyethelenes and SARAN
(b) Monofilaments, tapes, beltings, rattan, T-shapes, moldings.

National Plastics Inc., 2330 McCalla Ave., Knoxville 2.
(a) Thermosetting and thermoplastic compounds.
(b) Handwheels (lathes, etc.), sheaves, separators, idlers, take-up roll bearings and other textile machine parts, etc.

Niagara Insul-Bake Spec. Co., 483 Delaware Ave., Albany, N. Y.
(a) All thermosetting and thermoplastic materials.
(b) To customers' specifications.

North & Judd Mfg. Co., New Britain, Conn.
(a) RESINOX, BAKELITE, LUMARITH, PLASKON, LUCITE, PLEXIGLAS and BEETLE.
(b) Conduit insulators, etc.

Northeastern Plastics, The, 588 Commonwealth Ave., Boston.
(a) Acetates, styrenes and other thermoplastics.
(b) To customers' specifications.

Northern Industrial Chemical Co., 7 Elkins St., South Boston, Mass.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, etc.
(b) Telephones, radio, ignition and electrical parts, etc.

Northwest Plastics Inc., 2233 University Ave., St. Paul, Minn.
(a) BAKELITE, INDUR, DUREZ, MAKALOT, LUCITE, RESINOX, BEETLE and PLASKON.
(b) Industrial parts of all types.

Norton Laboratories Inc., 520 Mill St., Lockport, N. Y.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, TENITE, LUMARITH LUCITE, CRYSTALITE and PLASTACELE.
(b) Housings, terminals, bushings, wheels, knobs, handles, etc. All types of compression and injection molding.

Nosco Plastics, Div., of National Organ Supply Co., 1617 Cascade St., Erie, Pa.
(a) All thermoplastics.
(b) Cases, for refrigerators, also parts for accordians, aircraft, cameras, electrical instruments, musical instruments, radar, etc.

O

Ohio Rubber Co., Willoughby, Ohio.
(a) Rubbers.
(b) To customers' specifications.
See advertisement, Page 148

Oris Mfg. Co. Inc., 1 Jackson St., Thomaston, Conn.
(a) BAKELITE, DUREZ, RESINOX, BEETLE and PLASKON.
(b) Handwheels, bushings, etc.

Owens-Illinois Glass Co., Toledo, O.
(a) DUREZ, BAKELITE, RESINOX, PLASKON UREA, MELAMINE, BEETLE, LUMARITH, TENITE I and II, POLYSTYRENE, SARAN and ETHOCEL.
(b) Radio tube bases, small electrical and radio parts, electric motor brush holder screws, line connectors, etc.

P, Q

Paragon Plastics Inc., 911 Western Ave., Seattle 4.
(a) PLASKON urea and melamine, BEETLE, MELMAC, BAKELITE, Phenols and Ureas, ETHOCEL. VINYLITE, DUREZ and POLYSTYRENE (STYRON).
(b) Motor housings, generator collector rings, instrument handles, insulating parts, electrical junction boxes, generator collector ring assemblies, etc.

Peerless Molded Plastics Inc., 401 Hamilton St., Toledo, O.
(a) DUREZ, RESINOX, BAKELITE, TENITE, LUMARITH, LUCITE and PLEXIGLAS.
(b) Electrical, mechanical, radio, automotive, camera, etc.

Pittsburgh Plastics Co., 1304 Fifth Ave., New Kensington, Pa.
(a) BAKELITE, DUREZ, PLASKON, and other thermosetting materials.
(b) All types of compression molded parts.

Plastex Corp., The, 402 Mt. Vernon Ave., Columbus 3, O.
(a) All types of thermosetting and thermoplastic materials.
(b) Any fabrication or extrusion to customers' specifications.

Plastic Engineering, Inc., 8506 Lake Ave., Cleveland 2.
(a) TENITE, LUMARITH, LUSTRON, PLASTACELE, CHEMACO, LUCITE, POLYSTYRENE, VINYLITE, etc.
(b) Airplane parts, circulator fans, closures, fire extinguisher parts, radio parts, refrigerator parts, etc.
See adevrtisement, Page 314

Plastic Industries Inc., Kent, O.
(a) Thermoplastic and thermosetting materials.
(b) To customers' specifications.

Plastic Manufacturers Inc., Stamford, Conn.
(a) All types of thermosetting and thermoplastic materials.
(b) Aircraft accessories and rotors, contactors for electrical circuits for aircraft, collector ring assemblies, radar, etc.

Plastic Molding Corp., Sandy Hook, Conn.
(a) BAKELITE, DUREZ, RESINOX, MAKALOT, BEETLE, PLASKON, RESIN-X-CREPE, LUCITE, FIBESTOS, LUMARITH, TENITE I, acetate, polystyrene and VINYLITE.
(b) Insulators, wiring devices, bases, housings, connectors, etc.

Plastic Moldings Corp., The, 859 Hathaway St., Cincinnati 3.
(a) DUREZ, BAKELITE, RESINOX and PLASKON.
(b) Handles, cases, closures, brackets and parts to customers' specifications.

Plastic Products Inc., 415 Lexington Ave., New York.
(a) Any material which can be compression or injection molded.
(b) To customers' specifications.

Plastics Engineering Co., 1603 Geele Ave., Sheboygan, Wis.
(a) Thermosetting materials.
(b) Transfer and compression molded parts to customers' specifications. Also make plastic propeller blades.

Plastimold Inc., 61 Union St., Attleboro, Mass.
(a) BAKELITE, DUREZ, RESINOX, MAKALOT, BEETLE and PLASKON.
(b) Specialize in large housings, etc., compression molding.

Precision Plastics Co., 4655 Stenton Ave., Philadelphia 44.
(a) TENITE I and II, LUMARITH, FIBRESTOS, PLASTACELE, LUSTRON, LOALIN, LUCITE, CRYSTALITE, ETHOCEL, VINYLITE and POLYSTYRENE.
(b) Radio accessories, instrument parts, etc.

Presque Isle Plastics, Inc., 2730 W. 12th St., Erie, Pa.
(a) TENITE, CHEMACO, LUMARITH, STYRENE and all other injection materials
(b) Vacuum cleaner parts, handles, etc.

Pyro Plastics Corp., 526-532 North Ave., East, Westfield, N. J.
(a) TENITE, PLASTACELE, LUMARITH, FIBRESTOS, POLYSTYRENE, LUCITE and CRYSTALITE.
(b) To customers' specifications.

Quinn Berry Corp., 2601 W. 12th St., Erie, Pa.

(a) TENITE, LUCITE, LUSTRON, LOALIN, STLRON and VINYL (Various acetates, butyrates, acrylics, styrenes, vinyls, polyethylenes an dethyl-celluloses).

(b) Radios, refrigerators and automotive parts.

R

Rathbun Molding Corp., 290 Rochester St., Salamanca, N. Y.

(a) PLASKON, BEETLE, BAKELITE, DUREZ, MELMAC, RESINOX, DURITE and MAKALOT.

(b) Electrical parts, instrument parts, knobs and handles.

Recto Molded Products Inc., Appleton & B. & O. RR., Cincinnati 9.

(a) BAKELITE, DUREZ, RESINOX, PLASKON, TENITE, LUCITE, CRYSTALITE and MAKALOT.

(b) Control balls (all sizes) and handwheels.

Reinhold Plastic Mfg., F. E., 7001 McKinley Ave., Los Angeles.

(a) All types of thermosetting materials for compression molding. Press capacity 40-750 tons.

(b) Photographic and industrial assembly parts.

Remler Co. Ltd., 2101 Bryant Ave., San Francisco.

(a) BAKELITE, DUREZ, PLASKON, TENITE, etc.

(b) Electric terminals and switch parts, housings, handles levers, operating keys and buttons, gears, etc.

Reynolds Molded Plastics Div., Reynolds Spring Co., Cambridge, O.

(a) BAKELITE, PLASKON, TENITE, LUMARITH, DUREZ, LUCITE, RESINOX and POLYSTYRENE.

(b) All types to customers' specifications by compression, injection and extrusion molding.

Richardson Co., The, 27th and Lake Sts., Melrose Park, Ill.

(a) INSUROK, EBROK and RUB-EROK.

(b) All types to customers' specifications.

See advertisement, Page 162

Rogers, V. F., 2454—15th St., Denver 11, Colo.

(a) Phenolics and rubber.

(b) Instrument parts.

Rostone Corp., Rosite Molded Products Div., Lafayette, Ind.

(a) ROSITE inorganic plastic.

(b) From small intricate parts weighing less than an ounce to large panels of many pounds. Used in motor control equipment.

Royal Moulding Co., 69 Gordon Ave., Providence, R. I.

(a) BAKELITE, DURITE, RESINOX, DUREZ, PLASKON, BEETLE and MAKALOT.

(b) Electrical appliance housings.

S

St. Louis Plastic Moulding Co., 4605 Olive St., St. Louis.

(a) Cellulose acetate, POLYSTYRENE, VINYLITE, cellulose acetate butyrate (TENITE II), and LUCITE (methyl methacrylate).

(b) Extruded and injection molded parts.

Santay Corp., 351 North Crawford Ave., Chicago.

(a) Ethyl cellulose, cellulose acetate, cellulose acetate butyrate, polystyrene, methacrylates, etc.

(b) Radio, electrical, automotive, etc. to customers' specifications.

Shaw Insulator Co., 150 Coit St., Irvington, N. J.

(a) All plastic materials.

(b) All types of molded parts.

Snedaker & Co. Inc., Frank C., 9th and Tioga Sts., Philadelphia 40.

(a) Low pressure molding of impregnated sisal fiber, impregnated paper and fabrics.

(b) Housings.

Southern Plastics Co., 906-908 Main St., Columbia, S. C.

(a) TENITE I and II BAKELITE, LUMARITH, PLASTACELE and practically all thermoplastics and thermosetting plastics.

(b) Cotton loom sheaves, tubing, bearings, nameplates, strips, links, etc. All types of extruded and compression molded parts.

Specialty Insulation Mfg. Co. Inc., Hoosick Falls, N. Y.

(a) COLASTA, BAKELITE, DUREZ, TENITE, BEETLE, PLASKON, etc.

(b) Aircraft, electrical, household, radio, business machine parts, etc.

Standard Plastics Co., 62 Water St., Attleboro, Mass.

(a) Methyl-methacrylate, cellulose acetate, polystyrene and various thermosetting materials.

(b) All types of injection and compression molded parts.

Standard Products Co., 505 Boulevard Bldg., Detroit.

(a) BAKELITE, RESINOX, DUREZ and other thermosetting materials; TENITE, LUMARITH, POLYSTYRENE, ETHOCEL, LUCITE, PLEXIGLAS, LUSTRON, STYRON and other thermoplastics.

(b) Automotive, refrigeration panels and accessories, radio cabinets and parts, electrical housings, appliance parts, aircraft parts, etc.

Sterling Injection Molding Inc., 277 Military Rd., Buffalo.

(a) LUMARITH, FIBESTOS, TENITE I and II, ETHOCEL, PLASTACELE, VINYLITE, SARAN, LUCITE, PLEXIGLAS, POLYSTYRENE and other thermoplastics.

(b) Handles, rollers and other injection molded machine parts.

Sterling Plastics Co., 1140 Commerce Ave., Union, N. J.

(a) LUCITE, TENITE, LUMARITH, POLYSTYRENE, PLEXIGLAS, butyrate and acetate.

(b) Knobs, cigarette vending machine parts, nameplates, dehydrator tubes and dials for aircraft, compasses, etc.

Superior Plastic Div., Westchester Chemical Corp., 426 N. Oakley Blvd., Chicago.

(a) TENITE, LUMARITH, POLYSTYRENE, LUCITE and ETHOCEL. All types of injection molding and extrusion.

(b) To customers' specifications.

T

Taylor Mfg. Co., 3056 W. Meinecke Ave., Milwaukee 10. (also one in Racine, Wis.)

(a) Thermosetting materials.

(b) Compression and transfer molded parts to customers' specifications.

See advertisemnt, Page 289

Tech-Art Plastics Co., 41-01 36th Ave., Long Island, N. Y.

(a) All plastic materials.

(b) Compression and injection molded plastic parts for electrical and mechanical equipment and instruments.

Technical Plastics Co., 223 Main St., Zanesville, O.

(a) Cellulose acetate, cellulose acetate butyrate, polystyrene and vinyls.

(b) Small diam rod under ¼ in. and tubing under ¼ in. narrow, strip ½ in.

Telex Inc., Telex Park, Minneapolis.

(a) Compression and injection molding materials.

(b) Small parts.

Terkelsen Machine Co., 326 A St., Boston.

(a) DUREZ, INDUR, MAKALOT, BAKELITE, PLASKON and BEETLE.

(b) To customers' specifications.

Ther Electric & Machine Works, 17 S. Jefferson St., Chicago.

(a) DUREZ, BAKELITE, PLASKON, etc.

(b) To customers' specifications.

U

Union Insulating Co., P. O. Box 351, Parkersburg, W. Va.

(a) BAKELITE.

(b) All types for compression molding, for pumps, valves, etc.

United Plastics Corp., 3828 E. 91st St., Cleveland.

(a) Thermosetting materials, DUREZ, BAKELITE, etc. and thermoplastics.

(b) Small functional parts not over 7 oz.

U. S. Plastics Corp., 4029 W. Kinzie St., Chicago 24.

(a) Acetates, polystyrenes, LUCITE, BAKELITE, DUREZ, etc.

(b) Parts which can be injection and compression molded to customers' specifications.

United States Stoneware Co., Akron, O.

(a) Compression molding and extruding of TYGON synthetic resins, also compression molding and casting of DURALON resins.

(b) To customers' specifications.

V

Valley Plastics, Grafton, Mass.

(a) TENITE, PLASTACELE, LUMARITH, FIBESTOS and other thermoplastic injection materials.

(b) Knobs, handles, trim, etc.

Van Norman Molding Co., 4631 Cottage Grove Ave., Chicago.

(a) BAKELITE, DUREZ, DURITE, MONSANTO, PLASKON BEETLE and other thermosetting materials.

(b) Electrical meter cases and bases, connectors, etc.

Victory Mfg. Co., 1722 W. Arcade Place, Chicago 12.

(a) TENITE I and II, POLYTHENE, PLASTICEL, FORTICEL, LUCITE, LUMARITH, LOALIN, cellulose acetates, butyrates, polystyrenes, and ethyl cellose materials.

(b) Automotive and refrigerator parts, radio knobs, dials etc., for injection molding.

Vlchek Tool Co., The, 3001 E. 87th St., Cleveland 4.

(a) TENITE, STYRON, ETHOCELL, LU-

MARITH, LUCITE, BAKELITE, DURITE, DUREZ, PLASKON and VINYLITE.

(b) Any compression molded part to 125 in. sq. projected area: and any injection molded part up to 9 oz wt.

Voges Mfg. Co., The, 98 St. & 103 Ave., Ozone Part 17, N. Y.

(a) Acetate, polystyrene, methacrylate and any other thermoplastic materials.

(b) To customers' specifications.

Vulcanized Rubber & Plastics Co., 261 Fifth Ave., New York 16.

(a) Plastics and rubber.

(b) Injection molded plastic parts, and compression molded phenolic and rubber parts.

W, Z

W. & A. Co. Inc., 46 Union St., Attleboro, Mass.

(a) Plastic materials.

(b) Compression and inpection molded parts.

Warren Plastics Corp., Warren, Pa.

(a) BAKELITE, DUREZ, RESINOX, BEETLE, PLASKON, MAKALOT and TIONA.

(b) Small machine parts, plastic closures, attachment plugs and wire nuts.

Waterbury Companies Inc., The, 39 River St., Waterbury, Conn.

(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, SHELLAC COMPOSITION, LUMARITH, RESINOX, PLEXIGLAS, POLYSTYRENE, etc.

(b) All types of compression, transfer, high speed and injection molded parts to customers' specifications.

Watertown Mfg. Co., 138 Echo Lake Rd., Watertown, Conn.

(a) NEILLITE, BAKELITE, DUREZ, RESINOX, TENITE, LUMARITH, FIBESTOS, PLASTACELE, LUCITE, POLYSTYRENE, BEETLE, PLASKON, cellulose acetates and ethyl cellulose.

(b) Contact blocks, insulator blocks, switch housings, cams, spacers, radio cabinets, cases, washing machine agitators, insulation parts and any other moldable parts.

Werner Co. Inc., R. D., 380 Second Ave., New York.

(a) Cellulose acetate, cellulose acetate butyrate, ethyl cellulose, polystyrene, LUCITE, and the vinyl resins.

(b) Trim, hose, gaskets, angles, channels, special shapes, rods and tubes, etc.

White Dental Mfg. Co., The S. S., Plastics Dept., 10 E. 40th St., New York.

(a) All thermoplastic and thermosetting materials.

(b) Stock molded parts.

Windman Brothers, 3325 Union Pacific Ave., Los Angeles.

(a) BAKELITE, DUREZ, PLASKON, BEETLE, all phenolics and ureas.

(b) Electric razor cases, radio cabinets, electrical, mechanical, dental, photographic and surgical equipment parts.

Wolverine Plastics Inc., Milan, Mich.

(a) BAKELITE, DUREZ, TENITE, PLASTACELE, LUMARITH, PLASKON, LUCITE, SARAN and MONSANTO.

(b) Molded plastic parts, all types and sizes by compression, injection and extrusion.

Worcester Moulded Plastics Co., 14 Hygeia St., Worcester 8, Mass.

(a) TENITE, LUMARITH, SARAN, PLASTACELE, FIBESTOS, LUCITE, CRYSTALITE, POLYSTYRENE, STYRON, LUSTRON, LOALIN, VINYLITE and other thermoplastic materials.

(b) All types of thermoplastic molded parts.

Zenith Plastics Inc., 10100 Power Ave., Cleveland 14.

(a) All types of materials, specially acetate and butyrate types.

(b) Injection and compression molded parts to customers' specifications.

Machine Finishes Producers

Reference letters beneath addresses of companies refer to: (a) Tradename and type of finish, availability in color; (b) Method of application and drying; and (c) Characteristics and use of finish

A

Akron Paint & Varnish Co., Akron 1, O.

(a) Paint, varnish, enamel and industrial finishes.
(b) Baked and air dried.
(c) Protective; for all types of machines.

Alabastine Paint Products, Grand Rapids, Mich.

(a) Natural resin enamels, synthetic enamels, silk screen process lacquers, and other lacquers.
(b) Air dried.
(c) Protective; to customers' specifications.

Alrose Chemical Co., P. O. Box 1294, Providence, R. I.

(a) JETAL, black finish for ferrous metals; OXIDINE Z, a black nonreflecting finish for zinc and zinc plate; OXIDINE B, a black finish for copper and brass; BON WHITE, lustrous immersion tin finish for brass and copper.
(b) Chemical oxidation by immersion.
(c) Decorative, rustproofing, heat-resisting; for machines and appliances.

Aluminum Co. of America, Gulf Bldg., Pittsburgh.

(a) ALROK (aluminum oxide) colorless, bluish or greenish grey. ALUMILITE (aluminum oxide) colorless, dyed colors.
(b) ALROK—chemical; ALUMILITE—electrolytic.
(c) ALROK, corrosion and abrasion resistant; applied to aluminum parts for protection or as surface preparation for painting. ALUMILITE, better resistance to corrosion and abrasion; used for protection and decorative applications.

See advertisements, Pages 267, 271, 237

Aluminum Industries Inc., 2438 Beekman St., Cincinnati 25.

(a) PERMITE ready-mixed aluminum paint.
(b) For brushing, spraying, dipping and flowing.
(c) Decorative, corrosion, heat and weather resistant; for all types of metal products and equipment.

Amercoat Division, American Pipe & Construction Co., P. O. Box 3428 Terminal Annex, Los Angeles 54, (also 4554 N. Broadway, Chicago 40).

(a) AMERCOAT cold applied plastic coating; in white, black, cream, blue, gray, green, yellow, red and aluminum.
(b) Sprayed, brushed, dipped.
(c) Corrosion resistant to acids, salts, alkalies, etc., nontoxic, noncontaminative to food; for use on any type of machinery to prevent corrosion. Also applicable to concrete.

American Chemical Paint Co., Ambler, Pa.

(a) ALODINE coating for aluminum and alloys; CROMODINE for cold-rolled and hot rolled steel, steel forgings, cast steel, cast iron and malleable iron; CUPRODINE bright copper coating for steel; KEMICK paint for iron, steel and zinc surfaces in gray-black; COLD SPRAY-GRANODINE protective coating; and THERMOIL-GRANODINE phosphate coating.
(b) For spraying and dipping.
(c) ALODINE is abrasion and corrosion resistant; CROMODIZING is rustproof and eliminates flaking or breaking off; KEMICK is rust-preventive and a neutralizer for automobile exhaust manifolds and lines, airplane exhaust stacks and rings, etc; others furnish a protective coating on automobile sheet metal parts, refrigerator cabinets, etc.

American Products Mfg. Co., Oleander & Dublin Sts., New Orleans, La.

(a) INCELOID cellulose and resin bases, in all colors and iridescent.
(b) May be applied by any method; atmosphere and oven dried.
(c) Decorative; on all standard types of machines.

American Varnish Co., 1126-1140 N. Branch St., Chicago 22.

(a) Enamelized paint: in green, red, gray, yellow, orange, and blue.
(b) Sprayed and dipped.
(c) Decorative; for machines, tools, trucks, tractors and implements.

Apollo Metal Works, 6605 S. Oak Park Ave., Chicago.

(a) APOLLO pre-chromed metal, in bright and satin chrome and satin striped patterns.
(b) Plating.
(c) For conserving brass, copper, aluminum, nickel where corrosion resistance or reflectivity is desired.

Arco Co., The, 7301 Bessemer Ave., Cleveland.

(a) ARCO lacquers, baking synthetics and oil enamels; available in standard machine tool gray or special shades.
(b) Adaptable for any application method; air or force dried.
(c) ARCO is rust, heat and oil-resistant, for all industrial machinery.

Armstrong Paint Varnish Works, 1330 S. Kilbourn Ave., Chicago.

(a) ARMSTRONG paint, lacquer, enamel, varnish, etc., in all colors.
(b) All methods of drying and application.
(c) Rustproofing, decorative and heat-resisting; on all types of machines.

Auto Sun Products Co., 529 Poplar St., Cincinnati 14.

(a) SUN chrome, nickel, silver, copper nickel, tin, cadmium zinc, black nickel plating. Also SUN paint, lacquer and enamel in white, black, gray, green, ivory, blue, red and brown.
(b) Electroplated. Paints for brushing, dipping, spraying; electric, gas and air-dried.
(c) Plating for rustproofing and decorative purposes on radios, automobiles, etc. Paints also for decoration and rustproofing of radios, automobiles, aircraft, etc.

B

Baltimore Porcelain Steel Corp., P. O. Box 928, Baltimore 3.

(a) DURA-SHEEN porcelain enamel.
(b) For spraying.
(c) Rust and corrosion resistant; for machine use.

Benjamin Electric Mfg. Co., Des Plaines, Ill.

(a) BENJAMIN CRYSTEEL porcelain enamel on steel, in white, gray, red, green, blue, yellow and other special colors.
(b) Applied by spraying; dried by firing at 1550 F.
(c) For decoration, rustproofing, protection; heat-resistant; providing reflecting surface in lighting equipment.

Berry Brothers Inc., 211 Leib St., Detroit 7.

(a) Lacquers, in 7B light machine tool gray and blue-gray machine tool lacquers.
(b) For spraying.
(c) Rustproofing and decoration; for all types of machine tools.

Bownes, Frank Co., Chelsea, Mass.

(a) MODENE, mill whites and synthetic enamels and special finishes.
(b) For spray, brush and dip; air dried and baked.
(c) Decorative, protective; for machine tools

Bradley Laboratories Inc., C. E., Brattleboro, Vt.

(a) All types of industrial lacquers, enamels and paints, in colors to customers' specifications.
(b) For spraying and brushing.
(c) Protective and decorative; for all types of machines.

Brate Co., W. C., 14 Market St., Albany, N. Y.

(a) LUSTREBRIGHT bright nickel plating process.
(b) Plating.
(c) Decorative and rustproof, for all types of machines.

Byerlite Corp., 2300 W. Third St., Cleveland 13.

(a) GILBEY lacquer; in glossy black.
(b) For brushing, spraying, flowing or dipping, air dried.
(c) For rustproofing; on frames of machines

C

Carpenter-Morton Co., 77 Sudbury St., Boston.

(a) CARMOTE and LARCOLOID enamels, varnishes, etc., in a large variety of colors.
(b) Applied in all ways; air dried or baked.
(c) For rustproofing, decoration and preservation; on metalworking, woodworking, textile and other types of machines.

Chamberlain Engineering Corp., Akron, O.

(a) NEOLAC lacquer; in black, gray, clear, white, yellow, red, blue and aluminum.
(b) For brushing, spraying or dipping; air dried.
(c) Corrosion and moisture resistant; for use on any type of machine.

Chemical Corp., 54 Waltham Ave., Springfield, Mass.

(a) LUSTER-ON treatment for zinc surfaces, in a bright metallic color.

(b) Dipped.

(c) For decoration and corrosion protection; on all types of tools and machinery to eliminate fingerprinting.

Chemical Research Corp., P. O. Box No. 2002 Tulsa 1, Okla.

(a) RESISTAL HCL-340-A, -400, G-100, M-600; water-clear coatings, for metals and alloys.

(b) All can be brushed, sprayed or dipped, while G-100 type can be applied by roller coating methods; dry dust-free in 10 minutes.

(c) G-100 has excellent adhesion to all wood and metal surfaces; HCL-340-A to all metal aircraft exteriors without use of primer. All are tough, nonporous, durable and have high dielectric strength.

Chicago Vitreous Enamel Product Co., 1401-47 South 55th St., Cicero 50, Ill.

(a) Porcelain enamel FRITZ, inorganic finish, in all colors.

(b) Spraying and dipping.

(c) Abrasion, heat and acid resistant; rustproof. For application to steel and cast iron on gas and electric ranges, refrigerators, washers, space heaters, and industrial equipment.

Chromium Corp. of America, 120 Broadway, New York. (Plants in Waterbury, Conn., Cleveland and Chicago.)

(a) CRODON chromium plating (also copper, nickel, etc.).

(b) Electroplating.

(c) Decorative, rustproofing, hardness; for various types of machines.

Colonial Alloys Co., Technical Processes Div., Ridge Ave. and Crawford St., Philadelphia 29.

(a) PREPLATE plating process on aluminum in colors adaptable to plated coatings (wide range). ELECTRODIZING anodizing of aluminum and magnesium in all colors including pastels. CHEMOXIDE aluminum finish in red, brown, gold, green, black and gray.

(b) PREPLATE, electroplated; ELECTRODIZING, anodized; and CHEMOXIDE dipped.

(c) PREPLATE is abrasion and corrosion resistant; has good appearance and rubber adhesion; for use wherever aluminum is required. ELECTRODIZING is decorative, corrosion resistant, hard surfacing, and has good electrical insulation; for wherever aluminum is used. CHEMOXIDE is corrosion-resistant, also for application wherever aluminum is used.

Cooper Alloy Foundry Co., 200 Bloy St., Hillside, N. J.

(a) LUSTRACAST electrolytic finish.

(b) Electroplating.

(c) Decorative and protective.

Creutz Platers Inc., S. E. Third and Vine, Cincinnati 2.

(a) Gold, silver, copper, nickel, cadmium; lacquering and plating.

(b) Plating, spraying, etc.; oven, air drying.

(c) Decorative and rustproofing.

D, E

Dampney Co. of America, Hyde Park, Boston 36 (Thurmalox Div., Doylestown, Pa.)

(a) APEXIOR NOS. 1 and 3 black paints, THUR-MA-LOX NO. 7 black coating and THUR-MA-LOX aluminum coating.

(b) APEXIOR NO. 1 brushed; APEXIOR NO. 3 is brushed or sprayed; THUR-MA-LOX coatings are brushed or sprayed.

(b) APEXIOR NO. 1 protects water-exposed metal surfaces at temperatures above 212 F, APEXIOR NO. 3 at temperatures to 125 F; THUR-MA-LOX NO. 7 for surfaces exposed to temperatures of 1600 F, and THUR-MA-LOX NO. 10 for surfaces exposed to temperatures of 1200 F.

Davis Co., The H. B., 1600 Bayard St., Baltimore 30.

(a) Magnesium, steel, stainless steel, aluminum and black iron finish; also paints, enamels and varnishes, both in all colors.

(b) Both for spraying, dipping and brushing; the paints drying by air, baking or force drying.

(c) For decoration, rustproofing, heat resistance.

Day, James B., & Co., 1872 Clybourn Ave., Chicago.

(a) NITROLITE lacquer enamel; and a synthetic baking enamel.

(b) Lacquer sprayed or dipped and air dried; enamel sprayed and baked.

(c) Decorative; for metal machine parts.

Densol Paint Co., 9808 Meech Ave., Cleveland.

(a) DENSOTECH and DENSOL machine tool finishes. Former available in clear liquid; latter in NTBA gray, light gray, maroon, red, olive green and white.

(b) For brushing, spraying or dipping.

(c) Former for rustproofing and to preserve bright-plated finish on metal parts; DENSOL for use on all types of machine tools.

Dibble Color Co., 1497 East Grand Blvd., Detroit.

(a) DIBBLE standard machinery finishes in gray, black, white and red.

(b) For brushing, spraying; air drying, baking.

(c) Rustproofing; for milling and broaching machines, lathes, presses, etc.

Di-Noc Co., 1700 London Rd., Cleveland.

(a) DI-NOC transfer film involving special process to reproduce wood grains and other effects.

(b) May be applied to steel, wood, plastic and composition material, or furnished in form of prefinished sheets.

(c) Heat, cold and salt-spray resistant. For radios, automobiles, airplanes, air-conditioning units, business machines and similar equipment.

Dolan & Co., V. J., 1830 North Laramie Ave., Chicago.

(a) Lacquers and synthetics to customers' specifications, clear and pigmented.

(b) For both air drying and baking.

(c) For all types of special purposes.

Du-Lite Chemical Corp., Middletown, Conn.

(a) DU-LITE finishes for blacking of steel, copper, copper alloys, bronze, low brass, high brass and zinc.

(b) Immersion in hot chemical solutions.

(c) Decorative and rust resistant, reduce friction, cause no dimensional changes and aid in lubrication used on bearing surfaces.

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.

(a) DUREZ protective coating resins, in clear, black, white, or colors.

(b) For air drying, baking, direct heat or infra-red.

(c) Alkali, acid, solvent, and oil-resistant; weather-resistant primers for ferrous and nonferrous metals, and for finishing coats.

Egyptian Lacquer Mfg. Co., P. O. Box 444, Newark, N. J.

(a) EGYPTIAN lacquers and synthetics, in clear and standard colors; also to match.

(b) For spraying, dipping or brushing; air drying and baking.

(c) For protection and decoration, on all types of metal, and machine tools.

Enterprise Galvanizing Co., Cumberland & Almond Sts., Philadelphia.

(a) Hot dip galvanizing zinc silver-colored finish.

(b) For dipping.

(c) For use where corrosion resistance is required. In laundry machines, refrigeration, ice, textile and electrical machines, etc.

Esser Co., T. C., 3107 W. Galena St., Milwaukee 8.

(a) Industrial enamel, paint and varnishes in all colors.

(b) For brushing, spraying, dipping; air-baked or infra-red dried.

(c) For protection and decoration on all types and sizes of machines.

Essex Chemical Co., 438 Riverside Ave., Newark 4, N. J.

(a) DULAC universal lacquer No. 462, clear; and METALUSTRE lacquer and synthetic enamels, in most colors.

(b) DULAC sprayed and brushed, air dried; METALUSTRE sprayed or dipped.

(c) DULAC can be used on most metals, is protective and withstands outdoor exposure. METALUSTRE is decorative and protective, for all types of machines.

F

Felton, Sibley & Co. Inc., 136-44 N. 4th St., Philadelphia 6.

(a) 7-B Light Standard Tool Gray, Dark Standard Tool Gray, Eye Rest Green, Cream, black, bright red, blue gray, and steel gray, in one-hour dry synthetic gloss machinery enamel, 15-minute dry gloss machine lacquer, and overnight dry gloss machinery enamel.

(b) Synthetic and varnish base enamels brushed or sprayed, lacquer sprayed. Quick drying synthetic lacquer resisting primer, air dry 12 minutes, recoat with any top coat in 15 to 30 minutes.

(c) Decorative, rust-resistant and oilproof; for all types of machine tools.

Ferro Enameling Co., 1100-57th Ave., Oakland 1, Calif.

(a) FERRO-PORCELAIN enamel in all colors and shades.

(b) For spraying or dipping; heat dried.

(c) For decoration, rustproofing and heat resistance; for food machinery, pumps, etc.

Ferro Enamel Corp., 4150 East 56th St., Cleveland.

(a) FERROC inorganic porcelain finishes; in all colors and shades.

(b) For spray, dip; fire at approx. 1500 F.

(c) Decorative, rustproofing, cleanliness. For food, chemical processing, textile machinery, etc.

Forman, Ford & Co., 111 S. 2nd St., Minneapolis 1.

(a) FORMANITE enamels and wrinkle type finishes. Enamels in green, red and yellow; wrinkle finishes in green, blue, red and yellow.

(b) Enamels for dipping and flowing, air drying or baking. Wrinkle finishes brushed or dipped for baking.

(c) Both are decorative; for use on industrial equipment.

Frazer Paint Co., 2475 Hubbard, Detroit.

(a) FRATEX synthetic enamel and TUFTEX machinery enamel. Former in 20 standard enamels or special colors to match. Latter in 10 standard shades or special to match color.

(b) For spray or brush; air dry.

(c) For decoration and protection for all metal machinery.

Frost Paint & Oil Corp., 1209 N. E. Tyler, Minneapolis 13.

(a) FROST'S paints, varnishes, enamels,

lacquers in all standard colors and tints.
(b) For spray, brush, flow or dip; air, bake, and infra-red drying.
(c) Decorative, rustproofing, anticorrosion, heat and acid resistant, etc.; for machines of all kinds.

G

George Co., The P. D., 5200 N. 2nd St., St. Louis 7.

(a) PEDIGREE paint, enamel and varnish in any color.
(b) Brush or spray; air drying and baking.
(c) Decoration and protection; on all types of machines.

Glidden Co., 11001 Madison Ave., Cleveland 2.

(a) VULCOTE machinery finishes, oil-type enamels, synthetic enamels, and lacquer enamels.
(b) For brushing, spraying or dipping; and air drying or baking.
(c) Gives protection and aids appearance; for machine tools particularly.

Grand Rapids Varnish Corp., 565 Godfrey Ave., S. W., Grand Rapids 2, Mich.

(a) GUARDSMAN custom-made lacquers, enamels and varnishes in any color; and GUARDSMAN chrome, copper and aluminum in all metallic colors.
(b) Former for brushing, spraying, dipping and flowing; air or force dried. Latter are sprayed.
(c) For application on all types of machines.

Great Lakes Plating & Japanning Co., 1715 Bosworth Ave., Chicago 22.

(a) Electroplating of steel, brass, copper, bronze, zinc die castings, iron and brass castings and forgings of chromium, nickel, copper, cadmium, zinc, tin, brass and silver.
(b) Still and mechanical methods of application.
(c) For all types of machine parts.

H

Hague, Alfred, & Co., Inc., 227—34th St., Brooklyn.

(a) RUBALT No. 269 enamel; available in custom colors.
(b) Can be applied by any method; air dried or low baked.
(c) Rustproofing; for any type of machinery.

Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6.

(a) Modified XXX bright nickel finish. Company also produces copper, chromium, cadmium, zinc, lead, tin, bronze, brass, and silver finishes.
(b) Electroplating.
(c) Corrosion resistance, protection, rustproofing and decoration.

Heatbath Corp., Springfield 1, Mass.

(a) PENTRATE, penetrating finish in black only; PX finish available in black only.
(b) Immersion in boiling solutions; air-dried.
(c) PENTRATE for all steels except stainless; is rust-resisting, friction-reducing and has durability and good appearance. PX is for stainless steel, cast and malleable iron parts.

Heresite & Chemical Co., 822 South 14th St., Manitowoc, Wis.

(a) HERESITE phenol-formaldehyde resin finish in brown, gray, black, olive green and cream. VR-500 air-drying series, in black, brown and gray.
(b) HERESITE is sprayed, dipped, flow and roller-coated; oven baked. VR-500 applied by spraying, dipping and brushing.
(c) HERESITE is resistant to acids, alkalis and solvents rustproofing and also salt-water resistant. Use coating on rayon and textile machinery, torpedo parts, blowers and other machine parts.

Hilo Varnish Corp., 42 Stewart Ave., Brooklyn.

(a) HILO paints, lacquers, enamel synthetics in all colors; varnish, etc. Also black japans, and protective coatings to meet specifications.
(b) For brushing, spraying, dipping, flow coating, roller coating, and tumbling; infrared and air drying.
(c) Used for rustproofing and protecting all types of machines, equipment, etc.; also for protective concealment.

Hollingshead Corp., R. M., 840 Cooper St., Camden, N. J.

(a) WHIZ rust preventative compounds.
(b) Sprayed, dipped or brushed.
(c) For rustproofing. Used by U. S. Govt. for internal and external protection of all kinds of automotive and aircraft engines, etc.; as well as protection of rough castings and newly machined metal parts.

Hommel, O., Co., 209 Fourth Ave., Pittsburgh.

(a) HOMMELAYA and OHCOTE vitreous type coating in any color or shade.
(b) HOMMELAYA for any spray or dip; drier equipment. OHCOTE for spraying.
(c) Decorative, resistant to corrosion, heat and abrasion acid and salt spray. For any type of machine.

Hooker Glass & Paint Mfg. Co., 651 Washington Blvd., Chicago.

(a) KING machine and engine enamel available in color. No. 6132 standard machine tool gray enamel.
(b) For brush or spray; air dry.
(c) Decorative, protective, KING enamel for gas engines, steam engines, presses, machine tools, dynamos, etc. No. 6132 for woodworking and metalworking machinery.

Horn Co., A. C., Div. Sunchemical Corp., Horn Bldg., Long Island City 1, N. Y.

(a) Custom-made finish; paint, lacquer, enamel, varnish, etc.; in any color.
(b) Brushing, spraying, flow coating, dipping, etc.; air dried, oven-baked and infra-red lamp drying.
(c) For all types of machines.

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33.

(a) HOUGHTO-BLACK black oxide finish for blackening steel parts.
(b) By immersion in 295 F salt bath.
(c) Used where mild corrosion resistance and improved luster is desired. For war material, industrial machines, etc.

Hunsley Paint Mfrs. Inc., 1701 W. 7th St., Amarillo, Tex.

(a) Industrial synthetic enamel in black, white, yellow, red, brown, blue, light and bright green, maroon and beige. Also special colors.
(b) For brushing, spraying, flowing, dipping and roller coating; air dry-baked or force dried.
(c) Decorative, rust, heat and acid resistant; for plows, trucks, tractors, machine tools, presses, etc.

I, J

Indium Corp. of America, 1676 Lincoln Ave., Utica, N. Y.

(a) INDIFUSED Indium, silver luster finish.
(b) Plating and diffusion.
(c) Wear and corrosion resistant, decorative and functional; for nonferrous metals, etc.

Interchemical Corp., Finishes Div., Empire State Bldg., New York.

(a) POLYMERIN speedbake enamel, WRINKLE enamel, AULTONE lacquers, and PROTEKTOL stripping lacquer; all available in colors.
(b) POLYMERIN and WRINKLE applied by spraying and dipping; baked (all methods including infra-red). AULTONE applied by spraying; air-dried. PROTEKTOL applied by brushing and spraying; air-dried.
(c) Decorative, protective, heat and cold-resistant; for any part suitable for baking or other drying schedules.

Irvin, Jewell & Vinson Co., 17 E. Third St., Dayton, O.

(a) ANCO plastic paste form paint in special colors and white.
(b) For spraying, rubbing in, etc.; air dried, infra-red light dried, low heat.
(c) For use in filling indentations in plastic parts such as auto dials, refrigerators, etc.

Irvington Varnish & Insulator Co., 6 Argyle Terrace, Irvington 11, N. J.

(a) IRVINGTON enamels, in light, medium or dark gray and in light, medium or dark black.
(b) For brushing and spraying; air dried.
(c) For rultproofing motor and machinery frames.

Jones-Dabney Co. Industrial Div., Devoe & Reynolds Co. Inc., 1481 S. 11th St., Louisville 8, Ky.

(a) SYNTEX synthetic enamel in all colors. LUMIBRILLIANT in practically all shades, but particularly dark colors.
(b) SYNTEX applied by brush, spray, flow, dip, etc.; air-dried and baked. LUMIBRILLIANT is sprayed.
(c) SYNTEX offers protection and appearance, for refrigerators, washing machines, automobiles, farm equipment, etc. LUMIBRILLIANT is for protection and appearance in automobiles only.

K, L

Keystone Refining Co. Inc., 4821-31 Garden St., Bridesburg, Philadelphia.

(a) BELLEVUE and KERECO (first grade) paints, varnishes and enamels, also lacquers.
(b) For spraying and brushing; dry from 1 to 4 hours.
(c) For all types of machines.

Krome-Alume Inc., 241 Bewley Bldg., Lockport, N. Y.

(a) KROME-ALUME plated aluminum finish.
(b) Plating.
(c) For plating aluminum with nickel and chromium for decorative purposes; with nickel and chromium for wear resistance in machine parts; with brass for rubber adhesion; with copper for soldering by ordinary means and with such corrosion-resistant metals as cadmium, zinc, etc.

Lawrence & Co., W. W., 1124 West Carson St., Pittsburgh 19.

(a) Paint, varnish, lacquer, enamel, etc., in standard colors.
(b) Applied by spraying, brushing flow coating, dipping, etc.; for air drying, baking, etc.
(c) For all types of machines.

Lino Paint Co., 16908 Waterloo Rd., Cleveland.

(a) All types of machine finishes, including infra-red.
(b) For spraying, dipping or brushing; air dried or baked.
(c) For all types of machines.

Liquid Plastic Div., Ferro Enamel Corp., 4150 E. 56th St., Cleveland.

(a) VEDOC organic finishes in white and all colors to specifications.
(b) For spraying and dipping; dried by baking. Adaptable to infra-red.
(c) For washing machines, cabinets, appliances, and other machines.

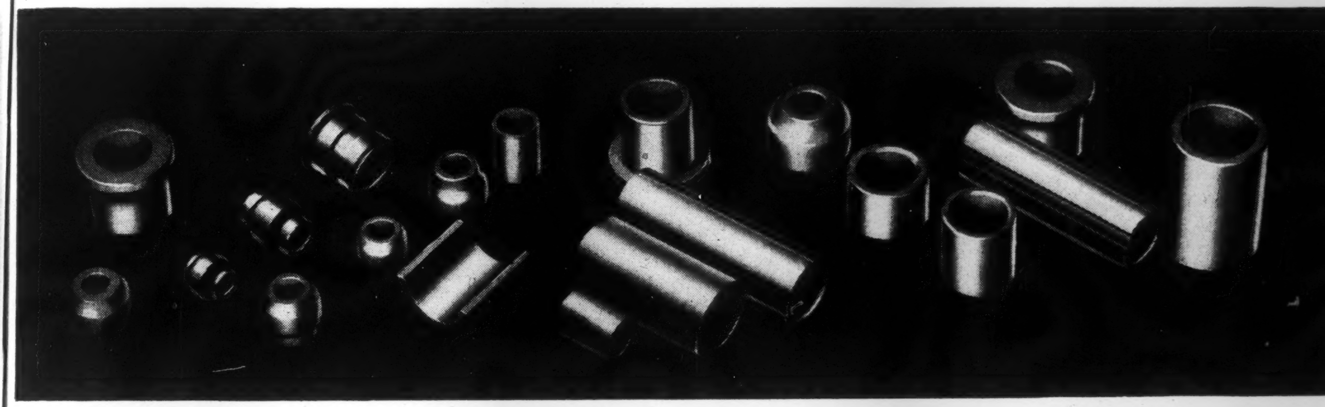
Long Jr. Co., Charles R., 1630-1644 W. Hill St., Louisville, Ky.

(a) STABRITE machine enamel in any color; also STABRITE wrinkle finish in any color except white.

The RIGHT *amount of* OIL *in the* RIGHT *place at the* RIGHT *time*

Oil is the lifeblood of a bearing. Proper lubrication forms a protecting film between the shaft and the bearing . . . prevents metal-to-metal contact . . . cuts friction to a minimum . . . prolongs the life of the entire motive unit.

One reason why Johnson LEDALOYL Bearings operate so quiet . . . so smooth . . . and for so long a time is the self-lubricating feature. Myriads of tiny, evenly spaced pores . . . as many as 13,000 to the square inch . . . serve as miniature oil wells. When the bearing is in use these pores meter the oil to the bearing area. When the bearing is at rest the oil is reabsorbed. Thus you always have the *right* amount of oil in the *right* place, at the *right* time.



in Powder Metallurgy *it's*

The dependable self-lubricating action of Johnson LEDALOYL provides many worthwhile savings to the designer. Expensive lubrication aids are eliminated and, in many cases, the bearings can be sealed in place. They are ideal for all types of household equipment. Write for complete, technical information.

JOHNSON BRONZE COMPANY
525 SOUTH MILL ST. NEW CASTLE, PA.

JOHNSON *Ledaloyl*
SELF LUBRICATING
REG. U. S. PAT. OFF.

BEARING BRONZE

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS

BRANCHES IN 18 INDUSTRIAL CENTERS

(b) Machine enamel for brush, spray, flow or dip; air dry or bake. Wrinkle finish for spraying only, and baking.

(c) Protective and decorative heat and oil resistant. Also special formulation for resistance to acids, alkalis, chemicals etc. For use on inner or outer surfaces of all types of machines. Supplied in wrinkle or smooth finish.

Lowe Brothers Co., 424 E. Third St., Dayton F-2, O.

(a) Lacquers, air-drying and baking enamels and paints in a wide variety of shades.

(b) Brush or spray, or both.

(c) Decorative and rustproofing; for machine tools and miscellaneous machinery.

M

McCloskey Varnish Co., 7600 State Rd., Philadelphia 36.

(a) MAN O'WAR enamels and varnishes, in white, gray, yellow, brown, tan, black, red, blue (Chinese and pastel), and light, dark and medium green.

(b) For brushing and spraying; air drying.

(c) Decorative, oil and rustproof; for all types of machines.

McDougall-Butler Co. Inc., Buffalo 5.

(a) HARDCOTE synthetic finishes in many color combinations; also varnishes, enamels, and paints.

(b) Brush, spray or dropper method; and dries dust-free in 15 min; hard in one hour.

(c) For inside or outside surfaces of wood, metal or plastics; corrosion-resistant.

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

(a) METALUSTRE lacquer enamels and synthetic enamels available in 30 standard colors. RAYDUR synthetic enamels in most colors. DUART WRINKLE enamels in most colors. CODUR enamels in colors. DYKAST lacquer enamels in most colors.

(b) METALUSTRE, spray, air dry and bake; RAYDUR, spray or dip, bake (Infra-red) ovens; DUART, spray; CODUR, spray or dip; and DYKAST, spray and dip, air dry.

(c) Decorative and protective coatings; METALUSTRE is used for sheet metal work and castings; RAYDUR on any machine requiring a tough, durable finish; DUART for cabinets and metal or Bakelite parts that can be baked; CODUR for any type of machine requiring moisture and chemical resistant finish; and DYKAST for zinc and aluminum die castings.

Merkin Paint Co. Inc., M. J., 1441 Broadway, New York 18, N. Y.

(a) MERKIN industrial enamel in colors.

(b) For brushing or spraying; air dried.

(c) For protective and decorative purposes on any machine where durability and "light-for-seeing" are factors.

Metaplast Co., 205 West 19th St., New York.

(a) METAPLATE plating of all metals on plastics.

(b) Plating.

(c) Decorative.

Mid Continent Paint & Lacquer Mfg. Co., 1921 Central St., Kansas City 8, Mo.

(a) MID CONTINENT synthetic and lacquer finishes in colors to customers' specifications.

(b) All methods of application and drying.

(c) For all types of machines.

Miller Co., J. Walter, Lancaster, Pa.

(a) Metallic finishes and lacquer in clear gold and black. Also copper, brass, nickel, tin and zinc plating.

(b) Brush, dip and spray; air-dried or steam-heated room.

(c) For rust prevention and decorative purposes.

Mitchell-Bradford Chemical Co., 2446 Main St., Stratford P. O., Bridgeport, Conn.

(a) BLACK MAGIC, WITCH DIP, WITCH OIL. Blackening processes for iron and steel, zinc and cadmium, copper and brass, and final oil and wax rustproofing finishes. Also SILCO, a glass base coating available in many colors and shades.

(b) BLACK MAGIC WITCH DIP and WITCH OIL applied by dip process, SILCO by spraying and baking.

(c) BLACK MAGIC, WITCH DIP and WITCH OIL corrosion-resistant finish for metal specialties, firearms, etc. SILCO for stove parts, strip heaters or wherever a corrosion, heat-resistant finish is required.

Mobile Paint Mfg. Co. Inc., 78 Dauphin St., Mobile 9, Ala.

(a) B.L.P. machinery enamel in any color.

(b) Spray or brush; air-dried.

(c) For rust-resistance, heat-resistance and decoration. For all types of machines.

Monsanto Chemical Co., Merrimac Division, Everett Sta., Boston 49.

(a) MONSANTO lacquers and enamels, and lacquer-enamel, in all standard colors.

(b) All sprayed or dipped; lacquer-enamel and lacquer air-dried; enamel is air-dried and baked.

(c) Protective, decorative coating; for all types of machines.

N

Never Rust Mfg. Co., 103 Lafayette, New York 13.

(a) NE-VER-RUST coating.

(b) For dipping or brushing.

(c) For machinery parts.

New Jersey Lacquer Co. Inc., 4400-4402 Dell Ave., North Bergen, N. J.

(a) PYROLAC lacquers, synthetic coatings; available in all colors.

(b) For spray, dip, brush; air dry and bake.

(c) Decorative, heat resistant, rustproofing; for industrial machinery, cinema projectors, cameras, typewriters, scales, electric instruments, navigation instruments, sound detection devices, electronic instruments, radar devices, etc.

New Jersey Zinc Co., 160 Front St., New York 7.

(a) Metallic zinc powder for coating.

(b) For spraying.

(c) Corrosion resistant, for all types of machines.

See advertisement Page 166

New Wrinkle Inc., Dayton, O.

(a) WRINKLE enamel in all colors.

(b) Applied by spraying; oven or infra-red dried.

(c) Decorative and protective; for all types of machines.

Nikolas & Co., G. J., 1227-1235 Van Buren St., Chicago (also 33 Grand St., Brooklyn, N. Y.).

(a) NIK-O-LAC lacquer in all colors.

(b) For brushing, spraying and dipping; air drying.

(c) For decorative and heat-resistant purposes; for all types of machines.

Nukem Products Corp., 111 Colgate Ave., Buffalo 20.

(a) NUKEMITE resin compound, in gray, red, black and white.

(b) For brushing or spraying.

(c) Chemical resistant; for use on machinery which will be exposed to corrosive conditions.

O

O'Brien Varnish Co., 101 N. Jackson St., South Bend 21, Ind.

(a) O'Brien's enamel, in yellow, red, green slate gray, machine tool gray No. 5819 and machine tool gray eggshell No. 6910

(b) For brushing or spraying; air drying.

(c) Decorative and rust-proofing; for all types of machines.

Ohio Bronze Powder Co., 1120 E. 152nd St., Cleveland 10.

(a) LUXRITE bronze powders, in aluminum gold, copper and other shades.

(b) Plating, spraying or dipping; air drying

(c) Rustproofing, heat-resisting and decorating; on agricultural and other types of machinery.

O'Neil Duro Co., 2156 S. Fourth St., Milwaukee

(a) DURO lacquer and synthetic enamel in any color.

(b) For brush, flow, spray or dip; for baking air drying or infra-red radiation.

(c) Decorative, rustproofing, heat resisting etc. For all types of machines.

P, Q

Paragon Paint & Varnish Corp., 5-49 46th Ave. Long Island City 1, N. Y.

(a) CYLBAK paints, enamels and varnishes

(b) For spraying, dipping or brushing; for high-speed baking.

(c) Specifically for use on aircraft engine cylinders.

Parker Rust-Proof Co., 2177 East Milwaukee Ave., Detroit.

(a) PARKERIZING, BONDERIZING and PARCO LUBRIZING.

(b) Spray or dip.

(c) Rustproofing and as a base for paint lacquer, enamel and oil finishes. PARCO LUBRIZING for bearing surfaces to prevent scuffing.

Parr Paint & Color Co., The, 18312-183-20 Syracuse Ave., Cleveland 10.

(a) Types X2725, X2193 and X818 machinery enamel; Type X2725 in gray, Type X2193 in all colors except white, and Type X818 in standard machine tool gray.

(b) All brushed or sprayed and air dried Type X2725 in 6-8 hrs, Type X2193 in 4 hrs, and Type X818 in 8-12 hrs.

(c) All are for decorative purposes; for all types of machines.

(b) Applied by brush and silk screening methods.

Pecora Paint Co. Inc., 3501 N. Fourth St., Philadelphia 40.

(a) PECORA paints and enamels in various colors.

(b) For brushing and spraying; air dried

(c) Decoration, rustproofing and heat resistance of all types of machines.

Pemco Corp., Baltimore 24.

(a) PEMCO, MIRAC, POROSEEL, POLYTONE, LECTRASEEL and PYRONAMEL enamels. Glazes in any color.

(b) For spray and dip; continuous dryer.

(c) For decoration, rustproofing and corrosion resistance, for all types of machines.

Perry-Austen Mfg. Co., 250 Parkinson Ave., Grasmer, Staten Island 5, N. Y.

(a) PAVOR chemical-resisting paint, in gray, red, yellow, green, white and black. PANOFLAM enamel in gray white, black and tints.

(b) Paint for brush or spray; air-dried. Enamel for brush or spray; air-dried or force-dried.

(c) For protection against corrosion, acids and alkalis; for structural materials in tanks and other types of machines.

FOR INCREASED TOOL LIFE—
LOW COST—ACCURATE PARTS USE
J&L COLD FINISHED STEEL

Your automatic screw machines will operate longer between tool changes when you use J&L Cold Finished steel. The uniform Controlled Quality of J&L Cold Finished rounds, hexagons and squares makes it possible for you to set the speed of your machines to obtain maximum efficiency. In addition the close dimensions and inherent machinability of J&L Cold Finished bars will make it possible to produce, at low cost, accurate, highly finished parts.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

J&L STEEL

Philadelphia Rustproof Co., 3229 Frankford Ave., Philadelphia.

(a) Chromium, cadmium, zinc, and alumiliting of aluminum, etc.

(b) Plating.

(c) All types of machines.

Pittsburgh Plate Glass Co., Industrial Paint Div., Grant Bldg., Pittsburgh.

(a) Pittsburgh Lavax machinery enamels, varnishes, lacquers and special process machine finishes.

(b) Suitable for all methods of application.

(c) Decorative and protective finishes for all types of machines.

Pratt & Lambert Inc., 75 Tonawanda St., Buffalo 7.

(a) P & L machine tool enamel and other enamels, paints, lacquers, varnishes, etc.; in any color.

(b) Brush, spray, flow, dip; air-dried and baked.

(c) Decorative, protective and as an aid in increasing production; for all types of machines.

Pyrene Mfg. Co., 560 Belmont Ave., Newark 8, N. J.

(a) UDYLITE, cadmium finish, in silvery-white; BRIGHT ZINC in silvery white; PYRENE BRIGHT NICKEL, thick deposits of high brilliance; BONDERITE, in gray paint base; CHROMIUM; ALUMILITE; PARKERIZING, silvery to variety of black finishes. ANODIZING by Alumilite process for protection and finishing of aluminum and its alloys. Also IRIDITE and CRONAK olive drab, black and yellow finishes for zinc, and PYLUMIN aluminum finish.

(b) Udylite, Bright Zinc, Bright Nickel and Chromium plating; Bonderite, Parkerizing immersion; Alumilite, electrolytic; Parkerizing chemical displacement without changing dimensions or physical characteristics.

(c) Rustproofing, decoration, as base for plating, or for wear resistance.

Quigley Co. Inc., 527 Fifth Ave., New York 17.

(a) TRIPLE-A industrial enamels in maroon, green, red, orange, gray, blue, buff, yellow, black, white, and aluminum.

(b) For brushing and spraying; dries by evaporation.

(c) Protective, waterproofing coating used on wide range of machinery and equipment.

R, S

Reilly Tar & Chemical Corp., 1615 Merchants Bank Bldg., Indianapolis.

(a) RESISCOTE paint, in gray, etc.

(b) Brush or spray; air dried or baked.

(c) Rustproofing, protection against corrosive gases, etc.; for all types of machines.

Roxalin Flexible Lacquer Co., 806 Magnolia Ave., Elizabeth, N. J.

(a) ROXAPRENE synthetic enamel, in all colors; RINCONTROL wrinkle enamel, in practically all colors.

(b) For spraying and dipping; RINCONTROL only for spraying.

(c) Both are decorative and corrosion resistant; ROXAPRENE used for air conditioning equipment, etc.; RINCONTROL used for business and electrical appliances.

Ruberoid Co., 500 Fifth Ave., New York.

(a) RUBEROID rapid asphalt paint, in black only.

(b) For spraying, dipping and brushing.

(c) Rustproofing, resistance to high temperature, acid fumes, etc. For cables, tubing, tanks, battery boxes, etc.

Rustless Iron & Steel Div., The American Rolling Mill Co., 3400 E. Chase St., Baltimore 13.

(a) Electropolishing, and Black Oxide finish for stainless steel.

(b) Applied electrolytically (anodic); while the Black Oxide is dipped in molten caustic dichromates.

(c) Polishing is for decorative, rust and heat resistance for wire parts too intricate for buffing; while the Oxide finish is for ordnance purposes and is heat and rust-resisting.

See advertisement Page 305

St. Louis Surfacer & Paint Co., 4200 Arlington Ave., St. Louis 20.

(a) LUSTR-LIFE enamels, in white, black, red, green, yellow and blue.

(b) For brushing and spraying; air drying and baking.

(c) For decoration, of various machines.

Sapolin Co. Inc., 229 East 42nd St., New York 17.

(a) SAPOLIN paints in all colors.

(b) Spray, brush, or dip.

(c) For decorative and protective purposes; for office machines, industrial, etc.

Seaporcel Porcelain Metals Inc., 28-20 Borden Ave., Long Island City 1, N. Y.

(a) SEAPORCEL standard and special porcelain enamels; in all colors.

(b) For spraying; hot air, then firing at 1550 F.

(c) Tenacious, will not chip unless base metal is fractured, will not corrode, heat-resisting, permanence of finish, ease of cleaning. Also applied to fabricated sheet metal parts of iron.

Seidlitz Paint & Varnish Co., 18th and Garfield Ave., Kansas City, Mo.

(a) SEIDLITZ DURMO finishes, synthetic enamels and primers, in snow white, black and all colors.

(b) For brushing, spraying or dipping; air dry or bake.

(c) Decorative and protective; for all kinds of machinery.

Sewall Paint & Varnish Co., 1306 River St., Dallas, Tex., and Sta. A, Kansas City 7, Mo.

(a) Engine and machinery enamels in engine gray, battleship gray, chrome green, dark blue, Brewster green and black.

(b) Brush or spray; air-dried.

(c) Decoration, rustproofing and heat resistance; for all types of machinery and engines.

Sherwin-Williams Co., 101 Prospect Ave., Cleveland.

(a) Sherwin-Williams enamels; also paints, varnishes and lacquers to suit individual requirements, and heat resistant finishes.

(b) Brush or spray; air drying or baking.

(c) For application to all types of machines. Enamels save finishing time; are durable.

Shiller & Co., M., 87 N. 12th St., Brooklyn 11.

(a) SHILLER paints, lacquers and enamels in all colors.

(b) For brush, spray, dip and flow; air dry or bake.

(c) Decorative, rustproof, heat-resistant and chemical-resistant; for all types of machines.

Sillers Paint & Varnish Co., Inc., 831 E. 61st St., Los Angeles 1.

(a) SILLERTEC synthetic enamel in yellow, orange, light green, dark green, dark gray, horizon gray, machine tool gray, cinnamon brown, No. 10 gray, red, medium blue, etc. Also SILLUX automotive synthetic enamel.

(b) SILLERTEC brushed or sprayed: SILLUX sprayed and air-dried (or force dried).

(c) SILLERTEC offers protection, decoration and resistance to oil and gasoline, for oil well equipment truck bodies, construction equipment, etc. SILLUX offers high gloss, durability for automobiles and other surfaces exposed where high gloss is required.

Simonize Co., 2100 Indiana Ave., Chicago.

(a) COROL removable rust preventive, semi-hard, in various grades to fit Government specifications and manufacturing requirements.

(b) For spraying, dipping and brushing; air-drying.

(c) For rust and corrosion prevention on all types of machines.

Solar Corp., 100 W. Bruce St., Milwaukee 4, Wis.

(a) SOLAR enamel in gray, red, orange, black, etc.

(b) For brushing, spraying and dipping; air, oven or bake dried.

(c) Decorative, rustproof and generally protective; for woodworking and metalworking machines.

Sonneborn Sons Inc., L., 88 Lexington Ave., New York.

(a) SONNEBORN'S machine and engine enamel in 14 colors. No. 3738 heat resisting gray enamel in light gray, and S.R.P. No. 75 red primer in reddish brown.

(b) Brush or spray; dry by air overnight.

(c) Machine and engine enamel is for decoration, oil-proofness, durability and withstanding heat up to about 200 F. Type S.R.P. No. 75 is used for rustproofing on various types of machines.

Southern Lacquer Co., 1426 Philpot St., Baltimore.

(a) CONFIDENCE BRAND lacquer in all colors.

(b) Brush, spray and dip; air drying and baking.

(c) Decorative and protective; for all types of machines.

Stakolite Co., 25 Stanhope St., Boston.

(a) STAKOLITE clear varnish.

(b) For brushing or spraying; air dried.

(c) Preservative for all types of surfaces. Resists acid, alkali, rust, steam, etc.

Standard Varnish Works, 2600 Richmond Terrace, Staten Island, N. Y.

(a) RINKOLIN wrinkle alkyd enamel in all colors. STANTOX synthetic enamel in all colors. STANDLAC lacquer in all colors. SVW aluminum lacquer or paint in aluminum only. ALPO polychrome metallic finish in light and medium shades. POLYPLASTIC synthetic enamels.

(b) RINKOLIN sprayed and baked. STANTOX sprayed and air dried. STANDLAC sprayed and air-dried. SVW aluminum is sprayed, dipped or brushed; air dried or baked. ALPO sprayed. POLYPLASTIC enamels sprayed or dipped; baked.

(c) All are protective and decorative coatings; for all types of machines.

Stonhard Co., 401 N. Broad St., Philadelphia 8.

(a) STONHARD Rustproofer furnished colorless-transparent. STONHARD acidproof coating in black. STONHARD steel protection coating in black.

(b) Rustproofer is sprayed, brushed or dipped; acidproof coating and steel protection coating both brushed.

(c) Rustproofer and acidproof finishes can be used on any metal part or machine, while the steel protection coating is for protection of structural steel parts and assemblies.

Sunbrite Mfg. Co., 3508 Market St., St. Louis 3.

(a) SUNBRITE chrome, aluminum, copper and all shades of gold, in all metallic colors.

(b) For spraying or dipping.

(c) Decorative and heat-resistant; for nearly all types of machines.

Sweney & Co., W. H., 43 East Water St., St. Paul 1.

(a) LION BRAND industrial finishes of all types with the exception of lacquers, in any color.

(b) For any method of application and drying.

(c) For all types of machines.

Expanded Metal Meshes
Provide *Greater Strength*
with Less Weight
PENMETAL STEELMESH
Expanded Metal
EXPANDED METAL MESHES
PENN METAL COMPANY INC.

In the fabrication of Penmetal Steelmesh, the steel plate is simultaneously slit and expanded. Steelmesh has greater strength per square foot—pound for pound—than any other material and is especially useful wherever lightweight with strength is essential. A minimum weight of steel is utilized as one square foot of steel sheet is expanded to become from four to five square feet of Steelmesh.

Suitable for the fabrication of a multitude of products. Can be cut, shaped and welded without raveling or joint failures.

Write for catalog and samples.

APPROXIMATE SIZES, DIMENSIONS AND WEIGHTS

STANDARD STEELMESH							FLATTENED STEELMESH				
Style Designation	U. S. Standard Gauge Steel Used	Weight in Lbs. Per Sq. Ft.		Stock Sizes of Sheets	Size of Mesh from Centers of Bridges		Weight in Lbs. Per Sq. Ft.		Stock Sizes of Sheets	Size of Mesh from Centers of Bridges	
		Plain	Galv.		Width	Length	Plain	Galv.		Width	Length
½″–#20	20	.50	.63	3′ & 6′ x 8′	.45″	1.2″	.47	.63	3′ & 4′ x 8′	.46″	1.28″
½″–#18	18	.74	.91	3′–4′ & 6′ x 8′	.45″	1.2″	.70	.91	3′ & 4′ x 8′	.46″	1.28″
½″–#16	18	.81	.97	4′ x 8′	.45″	1.2″	.77	.97	4′ x 8′	.46″	1.28″
¾″–#16	16	.50	.59	3′–4′ & 6′ x 8′	.95″	2.0″	.47	.59	3′ & 4′ x 8′	.97″	2.13″
¾″–#13	13	.80	.92	3′–4′ & 6′ x 8′	.95″	2.0″	.76	.92	3′ & 4′ x 8′	.97″	2.13″
1½″–#18	18	.20	.25	2′ & 4′ x 8′	1.34″	3.0″	.....	.....	.....	.....	.....
1½″–#16	16	.40	.48	2′ & 4′ x 8′	1.34″	3.0″	.38	.48	2′ & 4′ x 8′	1.34″	3.20″
1½″–#13	13	.60	.68	4′ & 6′ x 8′	1.34″	3.0″	.57	.68	3′ & 4′ x 8′	1.34″	3.20″
1½″–#10	13	.79	.89	4′ & 6′ x 8′	1.34″	3.0″	.75	.89	3′ & 4′ x 8′	1.34″	3.20″

PENN METAL COMPANY, INC.

Dept. 30, Parkersburg, W. Va.

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NEW YORK
PHILADELPHIA

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